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WHAT IS A HORSEPOWER?

While most electrical apparatus is rated in terms of electrical units, it is customary to express the capacity of electric motors in terms of the horsepower, and this unit consequently has great importance and interest for electrical engineers. It is not generally realized that the term horsepower, as it has usually been defined, does not represent a definite amount of power, since the value of the unit varies from place to place.

The horsepower is usually defined as representing the performance of 33,000 foot-pounds of work per minute, and a foot-pound is defined as the work done in raising a mass of one pound a vertical distance of one foot. This makes the horsepower depend upon the gravitational force acting upon a mass of one pound, and it is well known that the gravitational force varies with the latitude and with the altitude above the earth's surface. While this variation only amounts to a fraction of one per cent, it is nevertheless quite an appreciable value and it would seem highly desirable that this important unit should be so defined that its value is quite definite and everywhere the same.

The Standards Committee of the American Institute of Electrical Engineers has adopted the value of 746 watts as representing a horsepower. As the electrical units have been legally defined and represent more definite values than the mechanical unit here involved, it seems very desirable to define the horsepower in terms of electrical units and thus give it a more definite value than it has had in the past. The value of the horsepower has never been fixed by statute in this country, and if the necessity for the legal determination of its value should arise it is probable that the common definition stated above would be the one recognized. A legal enactment of a new and exact definition is therefore highly desirable, since an agreement for use or even a general adoption by all electrical engineers would not give a new definition any legal force or effect.

It would be highly desirable if all power, whether electrical, mechanical or thermal in its nature, were expressed in terms of watts or kilowatts, but since it can hardly be expected that men in all walks of life will be willing to abandon the more generally used unit of horsepower for the electrical unit, it seems highly important to define the former in terms of the more precise value of the latter.

WIRING IN UNFINISHED ATTICS.

In another section of this issue, members of the Executive Committee of the National Electrical Inspectors' Association discuss at considerable length the question of wiring in unfinished attics. This matter is one which certainly deserves greater consideration on the part of electrical contractors and inspectors than it generally receives, and the discussion referred to is both timely and important. The feeling is not unusual among owners of buildings that the electric wiring in such places should be of the cheapest possible type, particularly if it is supposed at the time the wiring is done that no use will be made of the attic after the wiring has been installed.

The feeling referred to might not be without justification if there could be positive assurance that the attic would not at some future time be used in some way or other. The fact is, though, that where an attic is reasonably accessible it is quite liable to be ultimately employed as a place for storing material which can be conveniently thrown across the upper edges of the joists. In view of this condition, it is the best practice to provide for all the wiring effective safeguards against mechanical injury and short-circuits which might result from this or similar causes. This is doubtless the real intent of the Code ruling in the matter in question.

A case is recalled where the attic in a building was accessible only from the outside, through a small window under the roof at one end of the house. The electrical contractors in the town were engaged in an unwholesome competition which resulted in prices for electrical work being cut to the lowest possible figure, and the man who wired this building ran part of the circuits on the top of joists in the attic, as one of the means employed to avoid financial loss on the job. Access to the attic being so difficult as to make it seemingly improbable that the wiring would ever be disturbed, the electrical inspector made the mistake of approving the work. Not long thereafter several buildings were burned by a fire which originated in the one just mentioned. The actual cause of the fire not being known, the usual procedure was adopted in assigning it to electrical origin, and the improper construction referred to was cited as proof of the opinion. The standing of the inspector in the town, and the business of the contractors and the central station as well, suffered from this experience.

The electrical inspector who permits wide deviations from the Code, or from the requirements of local rules, is on very unsafe ground, as a rule, and the wiring of unfinished attics is one of the poorest of all places at which to permit such deviations.

The construction of the attic may sometimes be such as to make good wiring here relatively expensive. Nevertheless, the investment is a wise one. It will be noted that throughout the discussion referred to above, protection from mechanical injury is insisted upon.

THE ADJUSTMENT OF POWER COMPLAINTS.

No phase of central-station work is more important than the adjustment of complaints from consumers bearing upon the quality and cost of service. The holding of business, and to no small degree, the securing of new revenue, are directly concerned with this problem. There is a tendency for complaints in the lighting field to overshadow those related to motor service, probably because of the personal element and because of the close regulation demanded in high-class illumination. Power complaints should receive the most detailed study, and if necessary a test should be made on the consumer's premises in his presence or with his representative at hand, to determine the real cause of trouble. The cost of such work may properly be borne by the central station, unless elaborate and expensive instruments and an unusual testing organization are required, when it may in some cases be feasible to divide the extra burdens involved. As a rule, there is less danger of captious criticism from the power user as compared with the lighting customer.

In a typical instance, a customer was using a 15-horsepower, single-phase motor in the operation of a woodworking factory. A complaint of high bills was received, with criticism of the voltage regulation. The central station made a somewhat delayed investigation and found that the low voltage was due to the fact that the transformer supplying current to the motor was over a half block distant. The high bill was found to be due to the poor load-factor of the motor, which ran for 75 per cent of the time with a load of five horsepower or less, and to the friction loss in the shafting. It was found that the complaint had been in some time before it received attention, and that as a result the plant owner had ordered an engine and boiler to take the place of the motor. After the cause of the complaint was remedied, the order for steam equipment was countermanded. As in many cases where motors are poorly fitted to their initial work or where changes in the machinery driven alter the loading conditions without the knowledge of the central station, the situation was cleared of trouble with little difficulty. The transformer was located near the motor, the line shafting divided and the machines regrouped, so that the lighter apparatus was driven by a five-horsepower motor and the heavier equipment by a 10-horsepower unit. The results were so satisfactory from the standpoint of bills and quality of service that when the plant was enlarged 45 horsepower more in electric motors was installed.

The case illustrates how attention to a complaint with a comparatively simple remedy saved the original business from being taken away and ultimately led to an increased patronage of 300 per cent. The moral is obvious, and is well worth the consideration of central-station managers.

THE ROMANCE OF GETTING RESULTS.

To those of us who are busy with the big and little details of things electrical, it rarely happens that we analyze at all deeply into the sense of appreciation of the outside world of the benefits which the science and art of electricity is conferring upon humanity. To those of us who are familiar to a certain degree with cause and effect to such an extent that what may be a mystery to others seems commonplace, we seldom pause to think that there are millions about us who have accepted the luxury and the convenience with the stolid indifference of those who, believing that they live in an electrical age, feel that they are entitled to all that this age can bring to them.

It is inspiring then to read what Arnold Bennett has to say in the July issue of *Harper's Magazine*. Here in a subtle way this most charming of British cousins, this keen observer of things human and mechanical, has brought out the romance of "getting results," that end of all ambition and all things economical and ethical to which the American business man aspires. Speaking of the telephone and its use by seven out of every ten souls in this country, he says:—"It is the efficiency of the telephone that makes it irresistible to a great people whose passion is to 'get results'—the instancy with which the communication is given, and the clear loudness of the telephone's voice in reply to yours: phenomena utterly unknown in Europe. Were I to inhabit the United States, I too should become a victim to the telephone habit, as it is practised in its most advanced form in those suburban communities to which I have already incidentally referred. There a woman takes to the telephone as women in more decadent lands take to morphia. You can see her at morn at her bedroom window, pouring confidences into her telephone, thus combining the joy of an innocent vice with the healthy freshness of breeze and sunshine."

Visiting one of the big telephone exchanges of New York, Mr. Bennett was impressed with the marvelous ingenuity of the system which made it possible for the millions of incoming and outgoing calls to be handled so dexteriously and, withal, so much exactitude. He says:—"A murmuring sound, as of an infinity of scholars in a prim school conning their lessons, and a long row of young women seated in a dim radiance on a long row of precisely similar stools, before a long apparatus of holes and pegs and pieces of elastic cord, all extremely intent: that was the first broad impression. One saw at once that none of these young women had a single moment to spare; they were all involved in the tremendous machine, part of it, keeping pace with it and in it, and not daring to take their eyes off it for an instant, lest they should sin against it. What they were droning about, it was impossible to guess; for if one stationed oneself close to any particular wrapt young woman, she seemed to utter no sound, but simply and without ceasing to peg and unpeg holes at random among the thousands of holes before her, apparently in obedience to the signaling of faint, tiny lights that in thousands continually expired and were rekindled. It was so that these tiny lights should be distinguishable that the illumination of the secret and finely appointed chamber was kept dim. Throughout the whole length of the apparatus the colored elastic cords to which the pegs were attached kept crossing one another in fantastic patterns."

From the telephone exchange Mr. Bennett visited one of the big power stations, and here again he has been inspired into a most poetic but withal a true picture of the situation:—"Having entered one of the palaces, simultaneously with a tornado of wind, we passed through long, deserted, narrow galleries, lined with thousands of small caged compartments containing 'transformers,' and on each compartment was a label bearing always the same words: 'Danger, 6,600 volts.' 'Danger, 6,600 volts.' 'Danger, 6,600 volts.' A wondrous relief when we had escaped with our lives from the menace of those innumerable volts! And then we stood on a high platform surrounded by handles, switches, signals—apparatus enough to put all New York into darkness, or to annihilate it in an instant by the unloosing of terrible cohorts of volts!—and faced an enormous white hall, sparsely peopled by a few colossal machines that seemed to be revolving and oscillating about their business with the fatalism of conquered and resigned leviathans. Immaculately clean, inconceivably tidy, shimmering with brilliant light under its lofty and beautiful ceiling, shaking and roaring with the terrific thunder of its own vitality, this hall in which no common voice could make itself heard produced nevertheless an effort of magical stillness, silence, and solitude. We were alone in it, save that now and then in the far-distant spaces a figure might flit and disappear between the huge glinting columns of metal. It was a hall enchanted and inexplicable. I understood nothing of it. But I understood that half the electricity of New York was being generated by its engines of a hundred and fifty thousand horsepower, and that if the spell were lifted the elevators of New York would be immediately paralyzed, and the twenty million lights expire beneath the eyes of a startled population. I could have gazed at it to this day, and brooded to this day upon the human imaginations that had perfected it; but I was led off, hypnotized, to see the furnaces and boilers under the earth. They took me to the twin palace, and on the windy way thither figures were casually thrown at me, as that a short-circuit may cause the machines to surge wildly into the sudden creation of six million horsepower of electricity, necessitating the invention of other machines to control automatically these perilous vagaries! As that in the downtown district the fire engine was being abolished because, at a signal, these power houses could in thirty seconds concentrate on any given main a pressure of three hundred pounds to the square inch, lifting jets of water perhaps above the roofs of skyscrapers! As that the city could fine these power houses at the rate of five hundred dollars a minute for any interruption of the current longer than three minutes—but the current had never failed for a single second! As that in one year over two million dollars' worth of machinery had been scrapped! And I was aware it was New York I was in, and not Timbuctoo."

National Electrical Contractors' Association Convention.

(By Telegraph.)

The twelfth annual convention of the National Electrical Contractors' Association was called to order at Denver, Colo., at 10:30 a. m., July 17. President M. L. Barnes introduced W. P. Carstarphen, who presented Governor John F. Shaffroth. Governor Shaffroth made a very happy address, felicitating the Association upon its activity in a great and growing industry. He spoke at some length respecting the development of water powers and the relation thereto of state rights. The Governor was followed by Henry J. Arnold, Mayor of Denver, who extended a cordial welcome to the delegates and their guests.

Maurice B. Bliss made an interesting address on the relation of the architect to the contractor, and C. N. Stannard, secretary of the Denver Gas & Electric Light Company, spoke on the relation of the central station to the contractor.

Closed sessions were held on Wednesday afternoon and Thursday morning and afternoon. On Wednesday evening there were a Rejuvenation of the Sons of Jove and a reception to President and Mrs. Barnes. On Thursday evening the banquet was held at the Albany Hotel. Friday was devoted to a trip to Corona over the Moffat Route. There were several hundred contractors and manufacturers' representatives present.

California Contractors to Meet at San Jose.

The California State Association of Electrical Contractors' will hold its third annual convention at San Jose, Cal., July 24, 25, 26 and 27. Special rates have been obtained, and the contractors and their friends will put in four days discussing problems for the improvement of the electrical business, and having a good time.

The officers of the Association are: J. C. Rendler, Los Angeles, president; C. H. Heilbron, San Diego, first vice-president; J. S. Reynolds, Santa Barbara, second vice-president; W. S. Hanbridge, San Francisco, secretary-treasurer; R. L. Booth, Los Angeles, sergeant-at-arms.

J. C. Rendler and W. S. Hanbridge are directors in the National Association of Electrical Contractors' and together with a delegation from all parts of the State, attended the national convention at Denver. They intended to use every endeavor to have the national body meet in San Francisco in 1915.

The California Association is coming to the front as one of the most active of the state organizations of electrical contractors.

Meeting of Missouri Electrical Contractors.

The semi-annual convention of the Missouri Electrical Contractors' Association was held at the Hotel Robidoux, July 13, preceded by luncheon. Thirty-five members of the Association, many accompanied by their wives, were in attendance. In the evening the visitors left in a special coach over the Burlington for Denver, where they attended the annual convention of the National Association of Electrical Contractors, July 17 to 19.

At the business session of the Association in the afternoon reports were submitted and discussed. The meeting was presided over by George Corrao, of St. Louis, state president. Officers were elected as follows:

Luther E. Reid, St. Joseph, president; William Koeneman, St. Louis, vice-president; A. J. Burnes, Kansas City, secretary; A. P. Denton, Kansas City, treasurer; A. J. Davies, Kansas City, sergeant-at-arms; E. S. Cowie, Kansas City, director.

In the evening the visitors were entertained at Lake Contrary and dinner was served at the Lotus Club.

At the luncheon were: R. V. Hughes, Kansas City; Frank P. Yenawine, St. Joseph; E. J. Kearby, St. Joseph; E. Zinsmeyer, St. Louis; W. L. Canneday, Fred Hummels, St. Louis; A. E. McCarthy, St. Joseph; George Kurschur, Kansas City; William Wurdack, St. Louis; Felix Andriano, St. Joseph; Mr. and Mrs. E. S. Cowie, Kansas City; George Corrao, St. Louis; W. L. Hutchins, Kansas City; L. E Reid, St. Joseph; K. G. Rennie, Kansas City; E. C. Van Nort, St. Louis; E. V. Hennecke, Pittsburg, Pa.; L. G. Reppell, Kansas City; Fred E. Geiss, Kansas City; A. P. Denton, Kansas City; C. A. Spaulding, Kansas City; Mr. and Mrs. O. L. Fickie, Kansas City; Mr. and Mrs. G. G. Burkeholder, Kansas City; Mr. and Mrs. J. T. Hopson, Kansas City; Mr. and Mrs. Charles J. Sutter, St. Louis; Mr. and Mrs. A. S. Doxsee, St. Louis; Mr. and Mrs. A. J Burnes, Kansas City; W. Dennison, St. Louis; William A. Koeneman, St. Louis; E. A. Koenenan, St. Louis; Charles Pierson, Kansas City; T. O. Strong, St. Joseph; H. E. Scover, St. Joseph; C. D. Fox, St. Joseph; R. L. Knopf, St. Joseph; E. L. Platt, St. Joseph; W. R. Thomas, St. Joseph; N. B. Johnson, St. Joseph.

St. Louis Electric Club Outing.

The St. Louis League of Electrical Interests entertained its members and the members of the local sections of the National Electric Light Association and the American Institute of Electrical Engineers and of the Engineers' Club, on an excursion on the steamer *Spread Eagle* on the evening of July 9. The steamer, one of the newest and fastest on the Mississippi, is limited by government regulations to five hundred members, and its capacity was taxed on this trip.

An elaborate dinner at 6:30 was followed by an address of welcome by Sam A. Hobson, president of the St. Louis League, his address being responded to by a representative of each of the organizations present.

Following a vaudeville entertainment, songs by Charles Brainerd and music by the Union Electric Light & Power Company orchestra, Frank B. Beardslee, sales manager for the Union Electric, was presented with a handsome umbrella, Mr. Beardslee being winner of a speakers' contest recently carried on by the League. Charles Sutter also received a very handsome prize, Mr. Sutter being the winner of a sub-contest carried on between the St. Louis electrical contractors.

A vote of thanks was tendered the Union Electric Light & Power Company, which donated the use of the boat and the orchestra, and to other liberal St. Louis houses which assisted in making the affair a success, and to Walter Rapp, of the Johns-Manville Company, chairman of the entertainment committee, who personally attended to vaudeville details in connection with the excursion.

Report of Chicago Board of Supervising Engineers.

The third annual report of the Board of Supervising Engineers, Chicago Traction, covering the fiscal year ended January 31, 1910, has recently appeared. This is a comprehensive document of 529 pages and sixteen chapters. In general the scope of the report is similar to that of previous ones, and it has been the special object to incorporate therein accurate data conveying information not only as to the board's activities, expenditures, etc., but also to make a permanent record of the more important work carried out, the precedents established, the standards developed and the technical investigations which it was necessary to make. The statistical material has been supplemented by numerous inserts of maps, charts and drawings showing the various types of construction employed.

At the opening ceremony of the annual meeting of the German Institute of Electrical Engineers, which took place in Leipzig on June 6, the Council of the (British) Institution of Electrical Engineers presented a portrait of Faraday, admirably painted by Miss Beatrice Bright, to Dr. Budde, the president of the International Electrochemical Commission, as a mark of personal esteem.

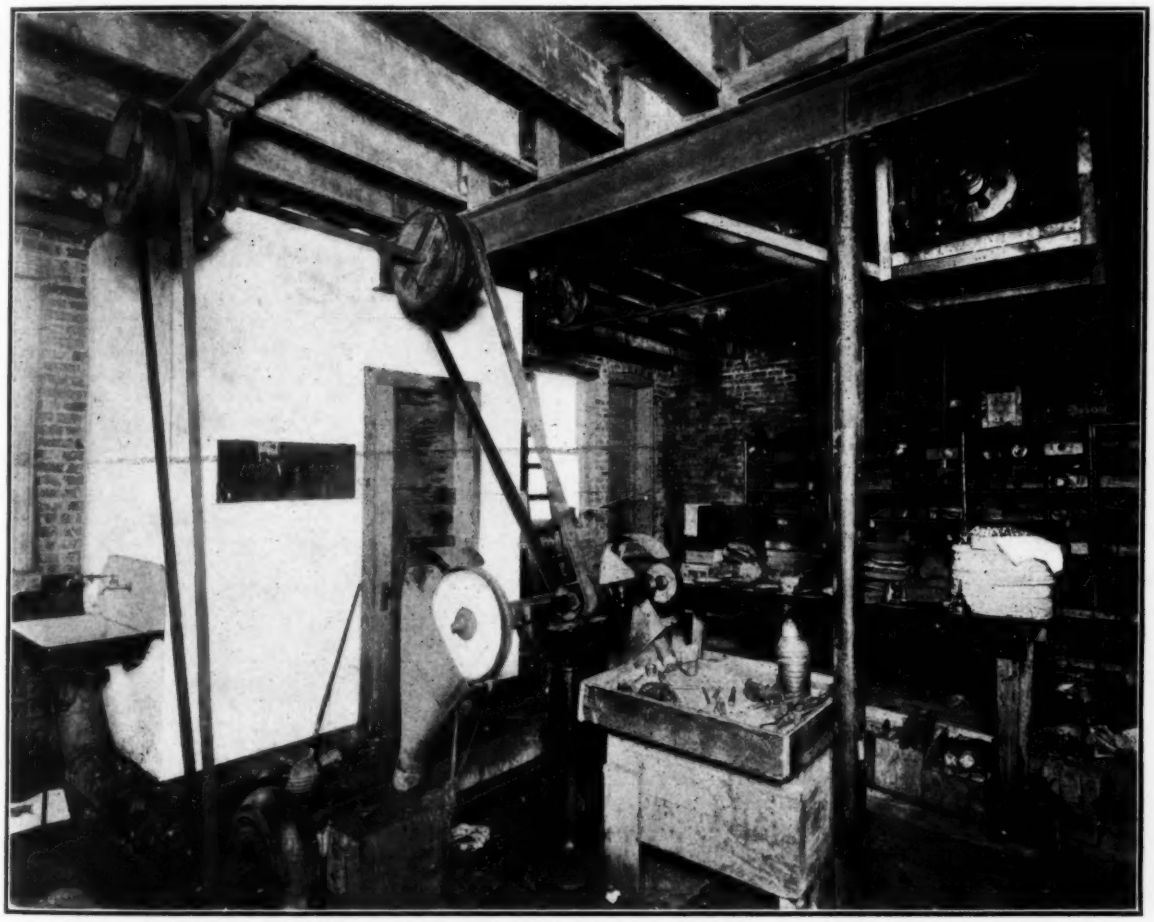
Electric Drive for Brass-Finishing Plants.

This article discusses some of the particularly salient features in connection with the installation of electric motors in brass-finishing plants and presents detailed data on the size, type and application of motors to the various machines. Information relative to five typical plants is tabulated in the data sheets.

Motor drive in brass-finishing plants and in the metal-working industries in general, has, for a number of years, been so successfully employed, and the resultant benefits so widely appreciated, that the following discussion is only intended to point out a few of the particularly salient points in connection with the adoption of this form of power.

One of the most important phases influencing the successful conduct of any manufacturing establishment is the amount of output obtainable with a given personnel, tool equipment, floor space and working time. Without increasing any of these factors, the substitution of mechanical drive by the installation of electric motors has variously augmented the productive capacity of different shops from 5 to 100 per cent. In other words, a greater amount of work is produced per operative machine per day, due to maintenance of speed under varying conditions of load; the ease by which the maximum cutting speed can be sustained throughout a given operation; the advantage gained by better arrangement of machines in regard to natural or artificial lighting facilities, as well as in the readier access to and sequence of material from the unfinished to the finished state; finally, because the greater cleanliness, purer air and generally better hygienic surroundings of the motor-driven shop react favorably upon the health, cheerfulness and activity of the operatives.

While increased production is obviously the most important result attained by the installation of electric drive, it is also true that direct economies are very frequently effected in the power costs. Apart from the saving in energy made possible by the ability of the operator to shut down those machines not engaged in productive work, the elimination of shafting, belts, pulleys, idlers, etc.,—which form an indispensable part of any mechanical system—must of necessity result in important power economies, especially if it is remembered that mechanical drives often consume from one-half to four times the energy required by the machines themselves. With individual motor drive the maximum power is made effective at the tool itself.



Five-horsepower Motor Mounted on Ceiling Driving Grinders and Blower. Englewood Chandelier Works.

The application of motors for operating machine tools in a manufacturing establishment may be divided into four classes: (1) Group drive at a constant speed. (2) Individual drive at

a constant speed. (3) Individual drive at an adjustable speed. (4) Cranes, hoists, elevators, etc. The selection of the type of motor and the question of group or individual drive depends upon a number of factors, viz., nature of the work, size or location of machine tool, percentage of time that machine is in operation.

In determining on the motor outfit for operating machine tools, one of the most difficult questions to decide is that of group or individual driving, and the most general solution is the combination of these two methods. The ideal method, and the one coming more and more into general use is to have the motor form an integral part of the machine. This method entirely eliminates belting and shafting, both main line and jack shafts. The saving in the cost of these mechanical transmission parts partially compensates for the installation of motor and controller.

The slip of belts introduces an uncertain factor in power supply which is entirely absent with individual motor drive. Furthermore, with individual motor drive the power delivered to the driven machine is automatically controlled and, in case of heavy demands, may greatly exceed the rated power of the motor, even for considerable periods of time. Thus a motor-driven machine is always capable of maximum production, while with belt drive and poorly adjusted belts the machine frequently balks before its full capacity is reached.

The even and easily manipulated speed control of machines individually driven increases their productive capacity to a very material extent.

Speed Regulation.—The most important advantage to be gained is a speed regulation adapted to the work. The convenience of securing the desired speed for maximum cutting, when electric drive is used, will result in a material increase in output. On most of the belt-driven machine tools the average increase of speed per step is about 50 per cent. For instance, the spindle speeds might run as follows: 10, 15, 23, 53, 70, etc. It was found by closely watching the work on these machines that while in many cases the speed was evidently too low for a given piece of work, yet the increase of speed to the next step was so great that the tool steel could not stand it. The controller used is such that the average increase of speed per step is about 10 per cent, i. e., 10, 11, 12.1, 13.3, 14.6, 16.1, etc. It will therefore be seen that the output per machine, and therefore per man, will be considerably increased, since it is possible to more nearly approach the working limit of the tool steel. In every shop the labor item is the largest single item of expense, and the saving of a small per cent of a man's time will amount to quite an item at the end of a year.

Electric drive gives steady power and permits great ease of speed regulation. The controller can be placed at the most convenient point, or, if advisable, two or more handles can be provided at different points, one being arranged to travel with the tool carriage. With the belt-driven machine more or less time is always lost in throwing a belt, and a negligent operator will not always take advantage of a change of speed on account of the exertion required to make the change.

It allows head room for cranes. A traveling crane can be used to great advantage in a machine shop, particularly for serving the larger machines. The effect of the electric crane on the economy of the shop cannot well be overestimated, though it is difficult to express in figures this economy.

Increased Light and Cleanliness.—With plenty of light and the absence of dust and dirt caused by shafting and belts, a workman surely ought to be, and usually is, inspired to do better and more efficient work.

Flexibility.—The machines can be placed to the best possible advantage and, if it should be necessary to rearrange them, it can readily be done.

If it is necessary to work a few machines overtime, a lot of power will not be wasted in running a shop full of shafting.

When a machine is not running it is not using power, whereas, in a belt-driven shop, the shafting is always running. Experiments have demonstrated that in an ordinary machine shop the shafting requires as much or more power than the power required to run the machines.

The absence of shafting simplifies the construction of the building.

Spindle Speeds.—A plate may be placed on each machine to show the different spindle speeds for each position of the controller handle with each run of gears, if there is more than one run, which will greatly assist a machine operator in determining the point at which to operate his controller.

Size of Motor.—In general the motor to be applied to a particular machine should not be determined by the average power required, but should be capable of caring for the maximum load required under severe conditions.

Motor Windings.—For machine tools having a rotary motion, such as lathes, milling machines, boring mills, drills, etc., shunt-wound motors may be used; while machines having a reciprocating motion, either of work or tool, such as planers, slotters, shapers, etc., should be equipped with compound-wound motors.

Machines having flywheels and in which work is done intermittently, as in punch presses, squaring shears, etc., should also have compound-wound motors.

Cranes, hoisting machines and large bending rolls are best driven by series-wound motors. Small bending rolls, however, may be operated by compound-wound machines. Where bending rolls are operated by a series motor the first notch of the controller should have a suitable resistance to prevent the motor from running away when the load is removed from the rolls and it is desired to keep the motor in operation.

Sizes of Motors Recommended to Drive Machine Tools.

The accompanying tables contain the sizes and speeds of motors usually employed with the average duty indicated for machine tools. The constant-speed motors are selected with a view to utilizing speeds as near possible to those obtainable with 60-cycle induction motors. By this means the same gear ratios can be employed with either direct-current motors or 60-cycle induction motors.

Boring Machines.—Where boring machines are specialized, performing only one operation, there is no good reason why the motor drive should be preferred to belt drives. Where, however, the machine is used for a multiplicity of operations, such as drilling, boring, reaming and facing, a motor drive is beneficial if a variable-speed motor is used. The range of speed of the motor should be as wide as possible, that no gears my have to be shifted for the entire set of operations on a single hole. Especially where a boring machine is used for facing, this variable speed will be found highly economical.

For extension boring mills, five-horsepower motors are used to move the housings on from 10-foot to 16-foot mills, 7.5 horsepower for from 14-foot to 20-foot mills and 10 horsepower for from 16-foot to 24-foot mills. The load-factor of the driving motor on boring mills averages from 10 to 25 per cent.

Drills require a shunt-wound, adjustable-speed motor with good regulation. Gear, chain or belt drive may be used. Belt is preferred to avoid breakage of drills. The load-factor of motor-driven drills is about 40 per cent, when the larger drills applicable thereto are used. If the smaller drills are used the load-factor averages 25 per cent and lower.

Drill Presses and Radial Drills.—Generally speaking, the upright drill is used for manufacturing operations and

does not require frequent changes of speed. There are, however, many exceptions, for instance, where upright drills are used to do all the operations on a piece by means of a jig. In this case frequent changes of tools, and therefore of speeds, are required, and an individual motor drive, whether direct-connected to the machine, or operating on the countershaft, is of the greatest benefit. No great benefit can be derived from a constant-speed motor with this type of machine. Radial drills may be considered the same as upright drills. There is an additional reason why radial drills should be motor driven—they are often used in the neighborhood of the assembling floor.

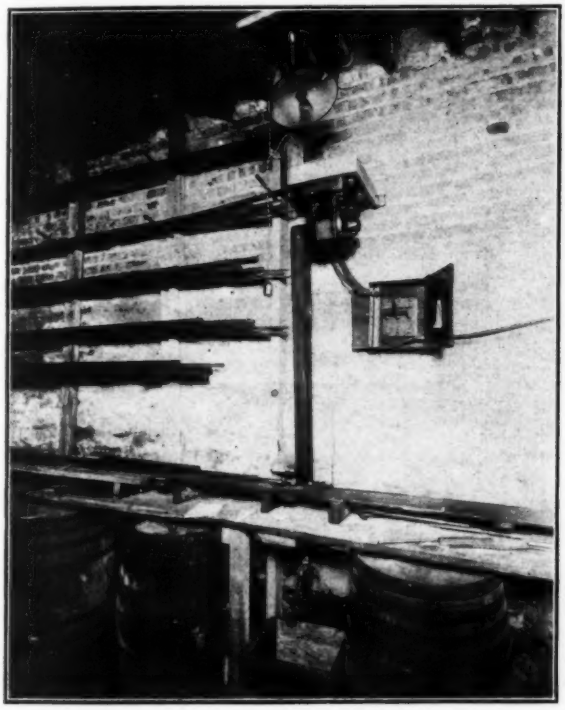
Lathes.—The average load-factor for motors driving lathes is from 10 to 25 per cent. On some special machines, as driving wheel and car wheel lathes, the cuts are all heavy, which increases the average load-factor to from 30 to 40 per cent. Lathes require shunt-wound, adjustable speed motors with good regulation. Gear, chain or belt drive may be used. The pressure on the cutting tool may be divided into two components, one for shearing the metal and the other for bending the chip.

Experiments have shown that for cuts of ordinary dimensions and shapes on the same material, the pressure on the cutting tool is nearly proportional to the area of the chip and is practically independent of the cutting speed. The pressure varies with the nature and hardness of the material and with the angle and sharpness of the cutting tool.

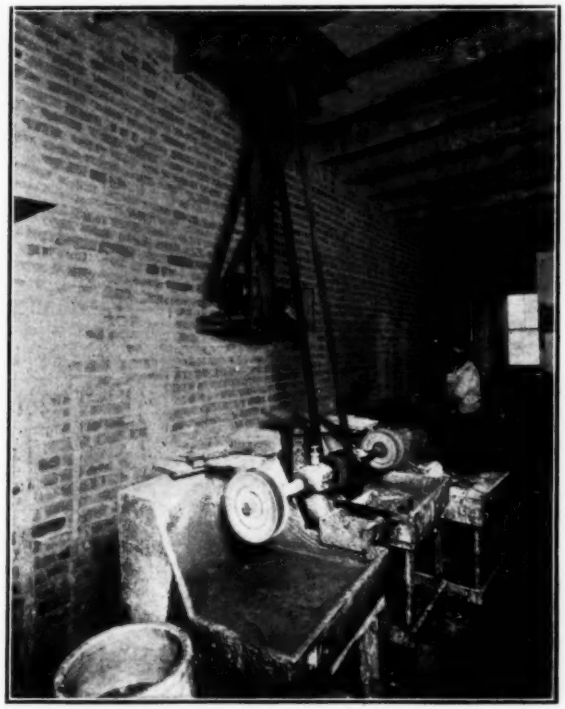
For high spindle speeds at small diameters of work on medium-size lathes, the power required to drive the tool idle is an appreciable amount, but under these circumstances, the size of cut and amount of power required is considerably smaller than with the maximum cut at ordinary cutting speeds and on ordinary diameters of work.

On very large lathes the power required to drive the tool idle is a small per cent of the maximum amount of power which can be absorbed by the cutting tools, and except in special cases, this can be neglected.

The amount of power can, therefore, be reduced to a simple formula, horsepower = constant × cubic inches of metal removed per minute. The value of this constant depends upon the nature and hardness of the material, dimensions of the cut, and angle and sharpness of the cutting tool.



One-horsepower Motor Belted to Tube Cutter. Englewood Chandelier Works.



Two-horsepower Motor Belted to Grinder. Englewood Chandelier Works.

Drill Presses, Sensitive.—The only reason why a sensitive drill should be individually motor driven is that it is often used in an assembling department, where height of ceiling and crane service would make a belt drive awkward or impossible. Most sensitive drills have in themselves all the speeds required for their work, so that any type of motor will be adaptable. The motor may either be directly applied to the machine or may drive a countershaft on a stand, or be placed on the floor by the side of the machine in case the machine carries its own set of cones or other variable-speed device.

Grinders.—Grinders in general require so many various movements driven from countershafts that it is hardly possible to apply a single motor directly to the machine. The best that can be done is to attach the countershaft to the machine and drive the former from a motor standing on the floor or on a bracket attached to the machine. In isolated cases it would be well to have one or more motors, each controlling a single operation, attached directly to the machine.

Average values of this constant for various materials are as follows:

Cast iron	0.33
Low carbon steel	0.5
High carbon steel	0.7
Brass	0.33

Experiments to determine the most satisfactory speeds for heavy cuts in various materials have shown the following results:

Cast iron	40 to 60 feet per minute
Cast steel	40 to 60 feet per minute
Low carbon steel	80 to 120 feet per minute
High carbon steel	50 to 80 feet per minute
Brass	150 to 200 feet per minute

In determining the proper speed variation for motors driving lathes there are two points to consider: The maximum speed is limited by the peripheral speed of pinions attached to the motor shaft, and this should be kept as low as 1,000 feet per minute for steel pinions meshing into steel

gears; the size, weight and cost of motor for a given output is dependent on the minimum speed.

Bench Lathes.—To be driven from a countershaft, attached to the wall or bench and driven in its turn by a motor. Any kind of motor, except a series-wound or heavily compounded motor, will do. The object of the motor drive is to get the machine in the best possible location without regard to the location of the line shafting. A number of these machines may be driven by a common line shaft, driven by a motor.

Chucking Lathes.—Generally speaking, there is little reason why a chucking lathe should be motor driven. Most chucking lathes are provided with the necessary mechanism to shift speeds quickly. A few types handling large work may be motor driven to advantage, though practically the only advantage lies in the fact that small graduations in speed can be thus obtained. Such machines therefore require a variable-speed motor.

Speed Lathes.—To be driven from a countershaft, located under the lathe, or by a direct-connected motor. In the latter case, a variable-speed motor is to be preferred, if direct current is available. Motor drive is recommended when the machine is used in the assembling department, as the machine may then be placed where it is most needed, and the assembling department being generally of greater height than other departments, crane service would interfere with countershaft. There will be no material gain, if the machine is to be used for ordinary shop operations.

Milling Machines.—The problem of a successful arrangement for motor driving on a milling machine has been found quite complex because of the peculiar service to which milling machines are put. The principal points to be considered in the design of such an arrangement are:

(a) The wide range and great number of speeds that are now a necessity for economical milling. (b) The large amount of power consumed, which requires a motor that is very large as compared to the size of the machine. (c) The fact of the large number of times a milling machine must be started and stopped in a day.

The only satisfactory arrangement of a direct-connected electric drive for milling machines is obtained by the use of an adjustable-speed motor which should be shunt-wound, direct-current machine. The variation in speed being obtained from the motor obviates the use of the usual mass of gearing.

The larger sizes of knee-and-column type machines, if motor driven, will give the best results if the motor is of the variable-speed type, especially where these machines are used for gang work. This is due to the fact that the speed of the mills is dependent on the largest cutter in the gang, while the feed is dependent on the smallest cutter, not counting the limitations due to the nature of the work. It is therefore important that the speed should be as close to the permissible limit as possible. When applied to this type of milling machine the motor should be as low down as possible, as vibrations in the machine have a marked effect on the quality of the finish.

The motor is mounted on an extension which is cast to and forms part of the base of the machine. This brings it near the floor, thereby adding to the stability of the machine and, as the entire motor arrangement is at the rear, it occupies space which would not be available for other purposes because it must be kept free to accommodate the table travel.

The motor used is shunt wound and capable of a speed adjustment of 2.5 to 1. This range is multiplied by the double-back gears, giving at the spindle a wide range of speeds.

For the average milling operations the load-factor averages from 10 to 25 per cent. On slab milling machines, where large quantities of metal are removed, it will average from 30 to 40 per cent. The work on this class of machinery is usually light and much time is required in making adjustments. Hence the load-factor is rarely higher than 20 per cent.

Planers.—On planers the load-factor averages between 15 and 20 per cent. The motor must be large enough to reverse the bed quickly, yet this peak load occurs for such short intervals that it does not increase the average load per cycle very much.

Three-horsepower Motor Driving Buffer and Blower.

Motor Driving Group of Brass Working Machines.

The power required to operate a planer for removing a given amount of metal by means of the cutting tool differs considerably from that required by a lathe. On account of the reciprocating motion, the speed of the planer is limited by the ability of the driving belt to stop, reverse and accelerate the platen.

The maximum cutting speed is usually below 40 feet per minute and a variation in cutting speed of 1:3 or from 13.3 to 40 feet per minute is all that will be required in most cases. For very hard or tough steel a cutting speed of 8 or 10 feet per minute is sometimes required and in special cases of light cuts on soft steel a cutting speed of 50 to 60 feet per minute has been used succesfully.

The speed of the return stroke should be kept up to a maximum, which, on ordinary planers, is limited to 80 feet per minute. The function of the motor drive for a planer consists in being able to change the speed

(Continued on page 107)

Brass Finishing Plants—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Brass goods manufacturing company located in Chicago. Running hours per week, 54

Total connected horsepower, 128.5. Total number of motors installed, 17. Average kilowatt-hours per month, 9,471. Average measured maximum demand, 44.7 kilowatts.

Kilowatt-hours consumption for 12 months: January, 8,396; February, 9,084; March, 7,286; April, 10,561; May, 9,241; June, 9,920; July, 10,571; August, 10,083; September, 9,539; October, 9,440; November, 9,670; December, 10,060.

Load-factor, 13.5 per cent; operating-time load-factor, 42.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current.

No.	Horse-Power	Application.
1	5	Belted direct to furnace blower.
1	5	Belted to line shaft driving one Gate cutter; one metal separator and one saw.
1	10	Direct-connected to freight-elevator mechanism.
1	10	Direct-connected to mechanism of passenger elevator.
1	5	Belted to a line shaft driving five spinning lathes and one metal saw.
1	5	Direct-connected to one electroplating generator.
2	15	Both belted to a single line shaft driving 12 double buffers; one wheel washer; one blower; one band saw; one grindstone and one tumbler.
1	5	Belted to a line shaft driving one vertical milling machine; one emery wheel; one small lathe and one magnet winder.
1	7.5	Belted to a line shaft driving three small lathes; two medium lathes; one large lathe; three quadruple drill presses; two triple drill presses and one single drill press.
1	7.5	Belted to a line shaft driving three Monitor lathes; nine medium lathes; one emery wheel; six speed lathes; three screw machines and one buffer.
1	7.5	Belted to a line shaft driving one gear cutter; one slotter; seven medium lathes; one small lathe and four milling machines.
1	5	Belted to a line shaft driving five medium lathes and three screw machines.
1	5	Belted to a line shaft driving five drill presses; one metal saw; four planers; four emery wheels; four large lathes and one grinder.
1	15	Belted to a line shaft driving eight metal presses; one small lathe; one triple drill press and one air compressor.
1	1	Direct-connected to a centrifugal pump.

Energy is supplied by the Commonwealth Edison Company.

Brass plant, name witheld, consisting of a foundry and machine shop producing 4,000 pounds of machined castings per day. Lubricators, plumbers' supplies and other brass articles are manufactured. The monthly output is approximately 50 tons.

Total connected horsepower, 150. Number of motors installed, 11. Average kilowatt-hours per month, 13,077. Maximum demand, 80 horsepower.

Kilowatt-hour consumption for 6 months: August, 13,285; September, 13,488; October, 13,877; November, 15,478; December, 11,194; January, 11,141.

Load-factor, 16 per cent.

The power consumption per ton of metal worked is approximately 268 kilowatt-hours.

MOTOR INSTALLATION.

Motors are of the squirrel-cage induction type. Supply source is two-phase, 60 cycles. 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	50	1,120	Belted to a 50-foot line shaft and a 50-foot countershaft driving 14 buffing wheels, 12-inch diameter.
1	15	1,120	Belted to a 50-foot line shaft driving three 10-inch emery wheels; one 24-inch by 2-foot rumbler; one sprue cutter; one 30-inch band saw; seven 32-inch turret lathes; one small punch; one magnetic separator; one small horizontal drill and one tapping machine.
1	20	1,120	Belted to a 50-foot line shaft driving one 1¾-inch tube cutter; one 15-inch drill press; one 20-inch drill press; one cock grinder; two 12-inch speed lathes; one bench filing machine; three 18-inch engine lathes; two 10-inch emery wheels; on sensitive drill; one 30-inch by 30-inch planer and one 12-inch forge blower.
1	15	1,120	Belted direct to a 36-inch exhaust fan, 750 revolutions per minute.
1	15	1,120	Belted to a countershaft driving a Clayton air compressor. 80 pounds pressure, 150 revolutions per minute.
1	3	1,720	Geared to a 14-inch by 3-foot Jones & Lamson turret lathe.
1	2	1,720	Belted to a 4-inch by 10-inch pump, pumping against a total head of 200 feet.
1	15	1,120	Belted to a 24-inch pressure blower furnishing blast to a hardening furnace.
1	2	1,720	Belted to a 10-foot countershaft driving one Cochran & Bly cold saw.
1	3	1,720	Belted to a 40-foot line shaft driving two Berkshire molding machines.
1	10	1,720	Belted to a 40-foot line shaft driving one 3.5-foot radial drill; one 20-inch drill press; two milling machines; one 16-inch turret lathe; one 12-inch turret lathe; two 10-inch tool grinders; one centering machine; one key seater, and one 26-inch furnace blower, one-ounce pressure.

Brass Finishing Plants—Data Sheet No. 2.

American Car & Ship Hardware Company, New Castle, Pa. This firm manufactures all kinds of hardware trimmings for cars and ships, such as brass brake handles, brass window brackets, brass jardnieres, etc. The approximate average output per day is 125 pieces, while the maximum is 450 per day. The average foundry output is 25 tons per month.

Total connected horsepower, 51. Total number of motors installed, 6. Average kilowatt hours per month, 5,571. Measured maximum demand 30.4 horsepower. Load-factor, 20 per cent.

Kilowatt-hour consumption for 11 months: October 5,890; November, 5,320; December, 5,337; January, 5,796; February, 6,225; March, 6,287; April, 5,345; May, 5,479; June, 4,964; July, 4,881; August, 5,765.

The electrical energy consumption per ton of output is 232 kilowatt-hours.

MOTOR INSTALLATION.

Motors all of the squirrel-cage induction type. Supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	7.5	1,120	Belted to a 26-foot shaft with five hangers and nine countershafts driving one Curtis 4.5 by 4.5-inch air compressor, 45 pounds pressure; one Brown & Sharpe No. 1½ milling machine; one double emery wheel; one 14-inch Porter lathe; one Strong, Carlisle & Hammond vertical 10-inch drill; one No. 859 Bement Niles horizontal boring machine; one Hendley 20-inch shaper; one Farrell No. 6 punch press; one Farrell No. 4 punch press.
1	10	1,120	Belted to a 50-foot shaft with nine hangers and 19 countershafts driving one W. F. & J. Barnes 22-inch vertical drill; one 12-inch hack saw; one double vertical drill, (24 and 26 inch); one G. S. Besley No. 10 Carborundum cloth wheel, 18-inch diameter; one 12-inch brass lathe; one Thomas K. Carey 12-inch lathe; one Meriden 15-inch lathe; two Warner & Swasey 16-inch lathes; one Fox No. 23, 18-inch milling machine; one Barnes 10-inch vertical drill; one six-inch lathe; two Pryibil 22-inch lathes; one eight-inch Warner & Swasey lathe; one Wood-Light & Company 30-inch lathe; one Brown & Sharpe six-inch lathe; one Pearson bolt machine; one 12-inch blower and three polishing lathes.
1	15	1,120	Belted to a 40-foot shaft with nine hangers and four countershafts driving one small metal lathe; one 42-inch blower; seven two-wheel polishing lathes; and one Hanson & Van Winkle direct-current plating generator, 4,000 watts, 4 volts, 1,300 revolutions per minute.
1	3	1,120	Belted to a 16-foot shaft (four hangers) and four countershafts driving one Carey 10-inch lathe; one Reed 10-inch lathe; one Pryibil 40-inch pattern lathe; one Barnes 10-inch vertical drill; and one combination rip saw and carborundum wheel.
1	5	1,120	Belted to a 25-foot shaft with five hangers and two countershafts driving one Diamond carborundum wheel; one 10-inch circular metal saw; one Barnes 24-inch vertical drill; two Smith 12-inch vertical drills and one Fitchburg 30-inch lathe.
1	7.5	1,120	Belted to a 10-foot shaft with three hangers and two countershafts driving one 24-inch American blower, 1,843 revolutions per minute; one 2 by 2-foot rattler; one 28-inch band saw; one throat shear and one double emery wheel.

Energy is supplied by the West Penn Electric Company.

Matthews Gravity Carrier Co., St. Paul, Minn. Combination drive. Running hours per week, 60.

Total connected horsepower, 20. Number of motors, 2. Average kilowatt-hours per month, 1,235.

Kilowatt-hour consumption for 12 months: January, 1,470; February, 1,304; March, 1,048; April, 1,128; May, 965; June, 1,048; July, 1,258; August, 1,346; September, 1,413; October, 1,326; November, 1,354; December, 1,171.

Load-factor, 13 per cent; operating-time load-factor, 31.8 per cent.

MOTOR INSTALLATION.

The supply source is two-phase, 60 cycles, 220volts.

No.	Horse-power	Speed R. P. M.	Application.
1	15	1,120	Belted to a line shaft driving one 2.5-inch tube cutter; one emery wheel; one R. & P. No. 4 punch press; one No. 38 punch press; two hack saws; one wheel roller; two forge blowers; two light combination punch and shears; one two-wheel emery grinder; one No. 32 punch; one two-spindle bolt cutter; one 50-pound trip hammer; one No. 1 punch press; one oil extractor; one Barnes drill press; one No. 10½ punch; one shaper; one 14-inch lathe and one 18-inch lathe.
1	5	1,120	Belted direct to one automatic screw machine.

Energy is supplied by the Consumers Power Company.

Western Brass Manufacturing Company, Chicago, Ill. Combination drive.

Total connected horsepower, 8.5. Number of motors installed, 2. Average kilowatt-hours per month, 498.

Kilowatt-hour consumption for 12 months: January, 298; February, 349; March, 438; April, 468; May, 508; June, 471; July, 285; August, 443; September, 730; October, 711; November, 678; December, 596.

Load-factor 10.7 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	7.5	1,120	Belted to a line shaft driving four brass lathes; two drill presses; two small emery wheels; two planers; and one milling machine.
1	1	1,200	Direct-connected to a 16-inch fan.

Energy is supplied by the Commonwealth Edison Company.

of the cutting stroke by small increments through a range of 1:3 and to have a high speed on the return stroke at all times.

The torque of the motor for one cycle is a variable quantity, and the maximum torque is usually required at the end of the cutting stroke for the reversal and acceleration of the platen to the high speed of the return stroke.

In order to reduce the increase in current on motor at the moment of reverse of platen, it is desirable to have a heavy rim on countershaft pulley which carries the belt for operating the planer on the return stroke. The motor should also be compound wound so that it will slow down slightly at the moment of reverse of plate, and thus permit the flywheel pulley to give up some of its stored energy and thus reduce load on motor.

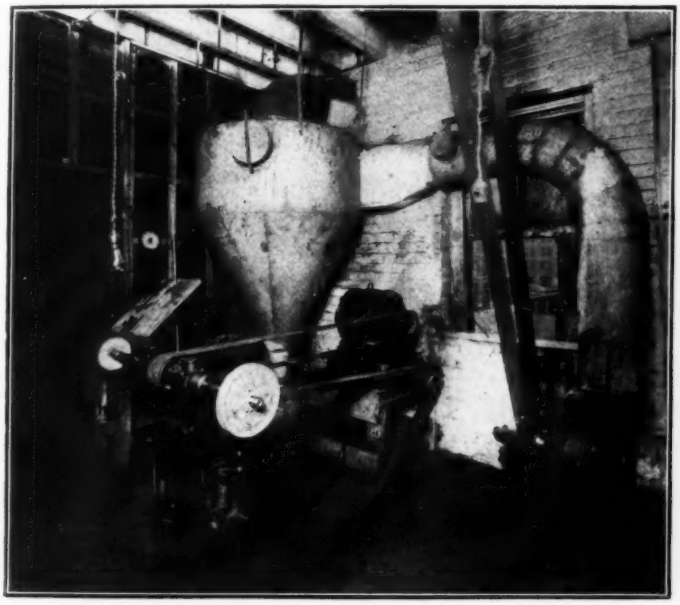
In order to obtain a variation in speed on cutting stroke with a constant speed on return stroke, a most satisfactory solution of the problem consists in the use of two countershafts mounted on the planer housings. On one countershaft, which may be called "A," is mounted the flywheel pulley which carries belt for driving planer on return stroke. This countershaft is driven by motor also mounted on the housings by means of gearing, chain or direct connection. The speed of this countershaft is always proportional to speed of motor. On the other countershaft, "B," is mounted a pulley which carries belt for driving planer on the cutting stroke. Countershaft "B" is driven from countershaft "A" by means of two or more runs of gearing, which will give two or more adjustments in the speed ratio between "B" and "A," and thus permit of adjustment in speed of cutting stroke with constant speed of return stroke. In order to obtain more finely divided gradations in speed of cutting stroke, the motor speed can be adjusted by means of field weakening, but the amount of speed increase for a compound motor should not be greater than 1:1.33.

A more common method of obtaining adjustment in speed of cutting stroke consists in operating the motor through a wide speed range, and using only one countershaft. This method has two objections: First, there is a corresponding variation in speed of return stroke, and, secondly, a larger motor is required if adjustment in speed is obtained by field weakening.

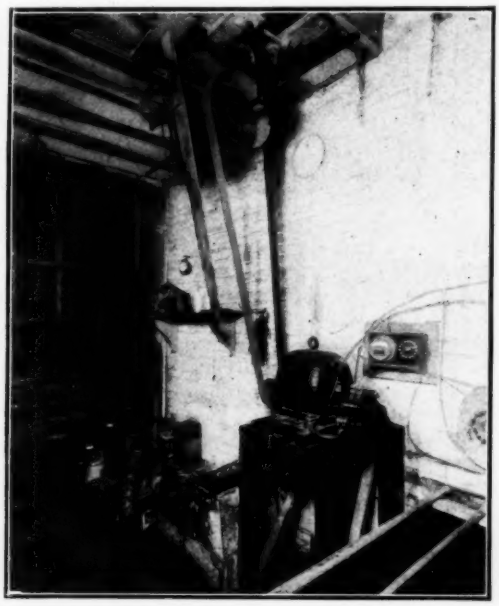
A planer may be termed a constant torque machine so that the horsepower required to operate it increases with the speed. In order to develop the required horsepower at the maximum speed on a field weakened motor, it is necessary that the motor be large enough to develop the maximum horsepower at the minimum speed. As a compound motor cannot be used for an amount of speed increase greater than 1:1.33, it is necessary to use a shunt motor with greatest intermittent overloads at weakest field which causes excessive sparking.

Screw Machines.—Small machines of this class are generally group driven. Large machines may be motor driven to good advantage. The larger sizes have generally one or two speeds for one piece of work, though these speeds may be varied when the machine is reset for a new piece of work. The speed given to the machine must naturally be proportional to the largest diameter to be turned, or, in other words, to the size of stock used. This will reduce the speed for some of the operations, such as drilling and reaming, far below the economical speed. The amount of time saved by the application of the variable-speed motor may be considerable. Where the construction of the machine permits, two motors, one for feed and one for speed, would give still better results. In all cases variable-speed motors should be used.

Shapers, Slotters, Etc.—What is true of planers is also true of these classes of machines. Local conditions may make it advisable to drive them individually by motor, but generally speaking, there is no great benefit with this drive. The work done on shapers is of a varying character. With light work the load-factor will not exceed from 15 to 20 per cent; with heavy work, the load-factor will be as high as 40 per cent. The conditions encountered on slotters are similar to those on shapers.



Motor Belted Direct to Grinder.



Plating Dynamo Driven by Belting.

Telephone Increase in Boston.

The fact that 191,000 copies of the summer edition of the Boston telephone directory for 1912 have been distributed, shows the rapid growth of the use of the telephone in that city. More than 839,000 calls are made daily in this territory, which includes 52 exchanges in the metropolitan district, and a total of 84 including the suburbs.

Commercial Practice
Management, Rates, New Business

POSSIBILITIES OF THE ELECTRIC SIGN.[1]

By W. S. Byrne.[2]

If the electric sign is to be in any sense a salable thing it must primarily have some features which recommend its use to the customer. Secondarily, and only as a result of the first, its desirability to the central-station man is to be considered.

Many years ago, at about the time modern advertising was taking the first toddling steps of infancy, a prominent soap manufacturer of the country sent parties of men down the Ohio and Mississippi Rivers painting the name of his soap upon every available space. This campaign arrested only passing interest until one night his men painted in glaring letters the words "Fels-Naptha Soap" on the very walls of a state penitentiary overlooking the Ohio River.

This aroused a storm of protest, and in commenting on it the editor of an Ohio paper said "some day some audacious sign painter will paint the very sky with letters of flame." Little did he know at the time that this prophecy would be literally fulfilled in the electric sign.

It is not to be my contention that the electric sign is the only, or even the best advertising medium, but I will attempt merely to set forth its advantages. Advertising to be effective must first have a large circulation among the people whom it is wished to reach. Granting we have fulfilled the first requirement the advertisement must be of such a nature as to compel attention and mark indelibly on the reader's mind the message it is to convey.

Nothing could better fulfill the first requirement than the electric sign. Every man, woman or child, whether he read any periodical or not, whether he ride or walk, is from time to time confronted with a well placed electric sign. A well designed electric sign is ever on the alert. If properly arranged it is effective by day as well as by night. Its circulation, if you may call it such, is limited only by the number of persons living in or passing through the city who can read, and even the latter limitation may be eliminated if a striking trade mark be displayed.

In the human being no sense is more keenly alert than that of sight. By no other of the five senses can we make a more marked or lasting impression on the brain. For this reason most advertising mediums convey their message to the consumer through the vision. What could better attract the eye than a well illuminated sign?

Granting now that you will allow my contention that the electric sign has the desired circulation and that it has the ability to arrest the attention of the consumer it is merely a matter of conveying a lasting message. A poorly worded sign has little to commend its use as an advertising medium. Often the merchant's name alone will appear on a sign. Now unless this name is a by-word familiar to every one it falls short in performing its duty, since the mere name conveys little meaning to the passerby. Why not the use of some one word, such as "SHOES" describing the goods he sells, or even better "JONES' SHOES"?

An electric sign is often useful as a means of identifying the merchant's place of business when used in conjunction with newspaper advertising stating that his wares may be found at a place designated by such a sign.

It is the practice with the Omaha Electric Light & Power Company to treat the sign purely as an advertisement, and to eliminate as far as possible the popular belief among merchants that sign lighting should be classed as a lighting expense.

I have to this point made an effort to justify the use of the electric sign. I will now treat it from the standpoint of the central-station man. The ever present difficulty in central-station operation is the tendency of peak loads to raise operating expense. Much capital is tied up in equipment to meet the demands during the peak-load period, and is, during the off-peak or major portion of the day practically inoperative. To obviate this difficulty, or in other words extend the earning power of this investment over a longer period of time has been the constant aim of every one concerned in station operation. To arrive at this result we may use either, or preferably both, of two systems. Either fill in and raise the gaps between the peaks or lengthen the time during which peak demands are effective. With this end in view operating companies are employing men to raise the day load by adding power load to the lines. But now have you ever thought of the electric sign as a means of extending the time of peak demand?

Generally speaking a sign is or should be operated from dusk to midnight. Then will not these signs tend to lengthen the peak to cover this period? To better assure that the sign operate over this period the Omaha Company has instituted a system of straight rates for sign lighting which specifies that for a fixed sum per month the sign will be lighted during the period mentioned above and kept in repair. If the sign be placed on a meter basis it is left to the judgment of the advertiser when his lights are to be turned on or off, and we have practically the same difficulty as is experienced in residence or store lighting. By a straight rate for a definite period of burning we arrive at a scheme whereby a portion, at least, of the income of the company is fixed.

Now as this portion of the total load increases, is it not readily seen that the total income of the system becomes more nearly a fixed sum? Does not the operating expense automatically adjust itself to a more nearly fixed basis as the income approaches this state?

It is my belief that there is not a central-station man who will not admit that this statement is true in an abstract sort of way. The theory at least is well founded. The following figures are taken from actual operating conditions, such as are attainable with any system and compare the consumption and load-factor on 24-hour basis of a dwelling house, and an electric sign of the same connected capacity.

Take for example a house of 20 50-watt lamps, and a sign of the same connected load (namely one kilowatt). The average consumption of that dwelling would be 54 kilowatt-hours per month. For the sign operated on a six-hour basis 180 kilowatt-hours per month. The load-factor of the former

1 Paper read before the recent annual convention of the Nebraska Electrical Association.

2 Industrial engineer Omaha Electrical Light & Power Company.

then would be 7.5 per cent as compared to 25 per cent for the sign. In other words, asuming a rate of 10 cents per kilowatt-hour for both classes of service the residence represents a yearly income of $64.80, whereas on the other hand the sign gives a gross income of $216, something over three times as much.

This comparison has purposely been made on moderate-sized installations, and becomes even more striking in larger ones, since in large houses a greater portion of the lights connected are for decorative purposes and seldom lighted.

In Omaha the practice has been to build, erect, and maintain the sign under contract for a stated number of months. By the time the contract has elapsed the cost of the sign has been paid back to the company in monthly installemnts included in the general lighting charges. The minimum term for which these contracts are entered into is two years. Care must be taken, however, to make the contract extend over sufficient time that the monthly charge for operating is not so large as to be prohibitive to the prospective customer.

In obtaining this business the first step has been to impress upon the customer its advertising advantages, and to push the sale along this line. Another scheme which has aided in obtaining this business is the practice of giving to the sign company in whose office the business originates the order for making the sign. The result has been that the sign men refer the customer to us.

Outing of the Brooklyn Edison Sales Department.

The "Peripatetic Perambulators" of the sales department of the Edison Electric Illuminating Company of Brooklyn, N. Y., gave their annual benefit at the Casino, Brighton Beach, Long Island, on July 2. Dinner was followed by five-minute speeches by H. P. Erwin, J. F. Becker, P. R. Atkinson, F. W. Smith, W. F. Wells, W. J. Ray, T. I. Jones and W. W. Freeman. M. S. Seelman, Jr., acted as toastmaster. This was followed by a burlesque in which many of the members of the company made dramatic reputations for themselves. The program of the affair was very ably prepared, and gave opportunity for the display of much wit and humor.

Low Cooking Rate in England.

A movement is on foot among the central stations in England to supply electric current for cooking purposes at one cent per kilowatt-hour, and a number of towns are already enjoying this rate.

Electric Signs for Real Estate.

That the real-estate field is one susceptible of development for electric-sign business is demonstrated by a successful campaign of this kind in Louisville, Ky. A special solicitor was appointed to take care of this department, and by studying the various real-estate developments of the city and submitting special propositions in each case, a large amount of desirable business was created. Several extremely large and handsome signs have been erected and it is believed that the field offers many other opportunities.

New Business of Brooklyn Edison Company.

During the month of June 1912, the Power Engineering Bureau of the Sales Department of the Edison Electric Illuminating Company of Brooklyn signed up a total business of 1391 horsepower, all new business. This included the replacing of five steam engines, eight gas plants and the cancelling of an order for a large gas engine, the entire horsepower secured being obtained by four power engineer salesmen.

Cost of Electric Cooking.

Some tests which have been carried out to show the cost of electrical cooking have been published recently in the London *Electrician*. The tests were made by Mr. Thompson, of the Saltburn Electricity Works.

Weight of raw pork	6 pounds 2 ounces		
Weight of cooked pork	5 pounds 4 ounces		
Loss	14 ounces=	14.2	per cent
Average loss with gas or coal oven		28	per cent
SAVING IN MEAT		13.8	per cent
Value of meat saved at 20 cents per pound		18	cents
Cost of cooking, 1.7 kilowatt-hours at 3 cents		5	cents
Saving after cooking is paid for		13	cents

With no more current passing through the oven, several pastries and cakes were cooked.

Weight of raw pork	4 pounds 4 ounces		
Weight of cooked pork	3 pounds 13 ounces		
Loss	7 ounces=	10	per cent
Average loss with gas or coal oven		28	per cent
SAVING IN MEAT		18	per cent
Value of meat saved at 20 cents per pound		17.5	cents
Cost of cooking, 1.5 kilowatt-hours at 3 cents		4.5	cents
Saving after cooking is paid for		13	cents

Weight of raw beef	6 pounds		
Weight of cooked beef	5 pounds 9 ounces		
Loss	7 ounces=	8	per cent
Average loss with gas or coal oven		25	per cent
SAVING IN MEAT		17	per cent
Value of meat saved at 20 cents per paund		19.5	cents
Cost of cooking 1:75 kilowatt-hours at 3 cents		5.5	cents
Saving after cooking is paid for		14	cents

With no more current passing through the oven, two sultana cakes and one milk pudding were cooked by the retained heat in the oven.

Weight of raw mutton	6 pounds 2 ounces		
Weight of cooked mutton	4 pounds 14 ounces		
Loss	4 ounces=	5	per cent
Average loss with gas or coal oven		22	per cent
SAVING IN MEAT		17	per cent
Value of meat saved at 18 cents per pound		13	cents
Cost of cooking, 1.5 kilowatt-hours at 3 cents		4.5	cents
Saving after cooking is paid for		8.5	cents

Soliciting.

The solicitor when he enters a new territory has first of all to get acquainted with his territory and conditions, and next to lay this out in sections to work at different times. After this is done he can begin making calls and obtaining prospects.

One very important part of soliciting new business is being prompt and exact in making calls when he has a date set, according to an article in a recent issue of the *Bulletin* of the American Gas & Electric Company.

A solicitor must be familiar with the various ways of handling prospective customers, as all of them cannot be talked to in the same way, for while many calls may be required to make a customer out of a prospect in one case, too many calls may lose him in another.

Always sieze the first opportunity and get the contract signed as soon as possible. After the contract is signed, try to see that the customer is pleased and let him know that you are interested, and be prompt in seeing that all complaints are attended to, to his entire satisfaction.

The greatest number of complaints at this season of the year come from the inability of the customer to use up the minimum amount of current charged him. These complaints can in many cases be settled by suggesting an electric iron, fan, or other appliance to enable the customer to get the benefit of the current which he must necessarily pay for.

Electrical Construction

ELECTRIC WIRING IN APARTMENT HOUSES.

Some Improvements Over Common Practice.

Correct design and installation in wiring an apartment house is a matter of very great importance. In any sort of building, of course, it is usually desirable to employ a neat and substantial type of construction. Moreover, in the case of the apartment house, as a means of insuring that the apartments will be easily rented, and that there will not be frequent changes of tenants, with apartments vacant for long periods between the departure of one tenant and the coming of another, it is important to exercise the greatest care in designing the wiring in such a way as to make the arrangement of circuits, outlets, switches and the like just as convenient as possible for people living in the building. The accompanying figures illustrate some recent improvements in apartment-house wiring, in the matters of locating the meters and providing vacuum-cleaner service. The installations illustrated are in Chicago.

Fig. 1 is a photograph showing the service-switch cabinet, cutout cabinet, meter loops and meters, and cabinets containing cutouts in circuits to the vacuum-cleaner motor, in an apartment house wired two or three years ago.

This installation of apparatus is in a basement room conveniently entered from the outside of the building, through a door to which the janitor carries the key.

The cabinet seen standing open in the left-hand side of the photograph is a sheet-metal box containing the service or main switch, this being located at the point where the electric circuit is brought into the building. Open-link fuses protect the service switch, and the door of the cabinet is held closed by means of a strong spring catch at its lower edge. The door opens to one side, so that gravity does not tend to keep it closed.

As the photograph shows, the meter loops are run as open wiring between the cutout cabinet—which is seen at the right of the service-switch cabinet just mentioned—and the meters themselves. The wires are brought out to the meters through metal bushings.

The motor which drives the vacuum cleaner in this apartment house is located in another basement room. The six small wooden boxes at the right-hand side of the large cutout cabinet contain cutouts in circuits which supply current to this machine. Each box is numbered, and is kept locked. The circuit passing through Box No. 6, say, comes from the load side of the meter which measures the power used in Apartment No. 6, and only persons living in that particular apartment have keys to this box. Whenever it is desired to use the vacuum cleaner in the apartment, the box referred to is unlocked, the fuses placed in the cutout, and the motor started up. Similarly for the other five apartments in the building.

The main cutout cabinet is mounted on a support made of boards and attached to the brick wall of one of the partitions. The wiring to the wooden boxes just mentioned is in flexible tubing, as the photograph shows. The six lines of conduit leaving the main cabinet at the top carry the vertical risers which supply the apartments above with current.

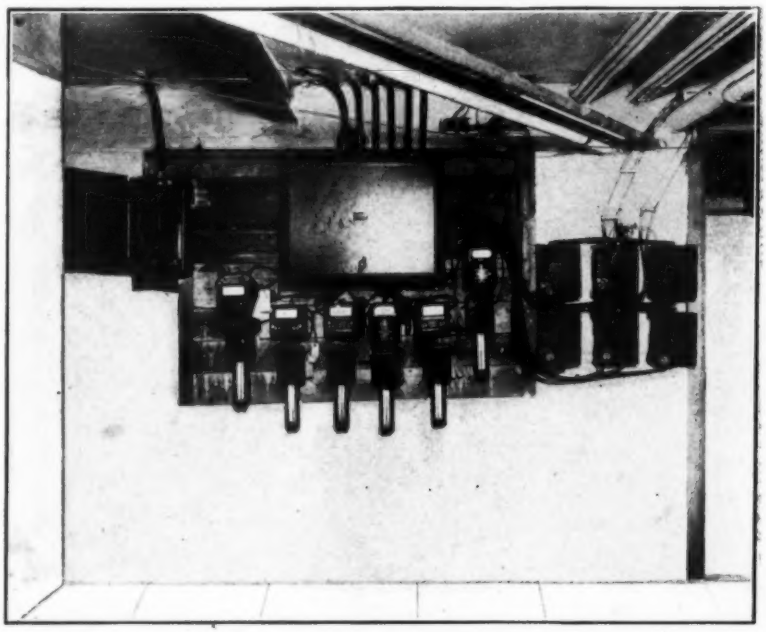


Fig. 1.—An Older Method of Installing Meters and Motor Connections.

While the construction illustrated in Fig. 1 is an improvement over work often found in apartment houses, the construction shown in Fig. 3 is in many ways superior to that shown in Fig. 1. Fig. 3 is a photograph taken in the basement of a twelve-apartment building in which the wiring has just been completed and the installation put into service.

The building referred to in Fig. 3 is separated electrically into two sections, and the photograph was taken in what may be called Section 2. The main service switch and fuses are located in the basement of Section 1, where a three-wire, 220-110-volt alternating-current service is brought into the sheet-metal cabinet containing the main switch and fuses From this point two lines of conduit carry three-wire feeders to two main cutout cabinets, one of which is seen near the center of Fig. 3. The installation in Section 1 is the duplicate of that shown in the photograph, except that the vacuum cleaner seen in the figure serves the entire building. The conduit containing the feeders running from the service switch may be seen entering the cutout near its upper left-hand corner, in, Fig. 3. The smaller tubes ex-

tending upward from parts of the box near its opposite end contain the feeder circuits to the various apartments.

The method employed in running meter loops in this building is well shown in Fig. 3. It will be noted that, for each meter, conduit is run from the cabinet to a point very near the meter, where it terminates in a condulet fitting, through which the meter loop is brought out, this being a great improvement over the construction shown in Fig. 1. The conduits from which free ends of unused wires are seen projecting contain loops for meters for apartments not yet occupied.

It may be remarked, in passing, that a still further improvement in the matter of running meter loops has lately been introduced in Chicago. This consists in having the conduit in which the wires for the meters are run terminate in a fitting with a removable cover and having inside it screws similar to those on a porcelain fuse block—to which the wires may be attached. Wires are brought from the cabinet to one set of terminals within the fitting, while from another set, connected electrically with the first, short connecting wires are extended to the meter. With such construction the protruding unused ends of wires seen in Fig. 3 are not necessary; for the conductors from the terminal fitting on the meter-loop conduit are not installed until the meter is to be connected up, and when a meter is taken down, the cover of the fitting may be removed and these wires readily taken away.

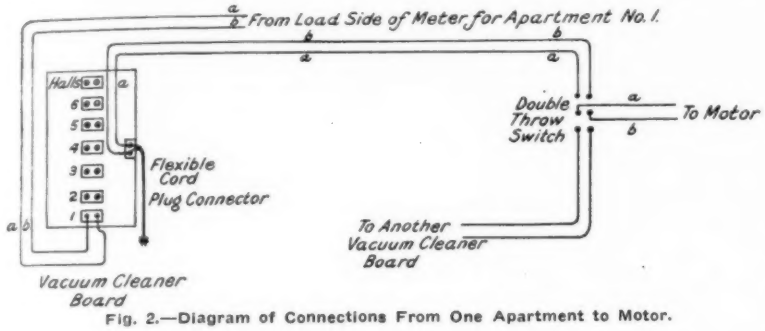


Fig. 2.—Diagram of Connections From One Apartment to Motor.

In the apartment houses in question maximum demand indicators are used with all meters except those employed in measuring power in hallways. Such indicators are seen near the meters with which they are connected in Fig. 3. The meter at the left of the cutout cabinet serves hallways in this section of the building.

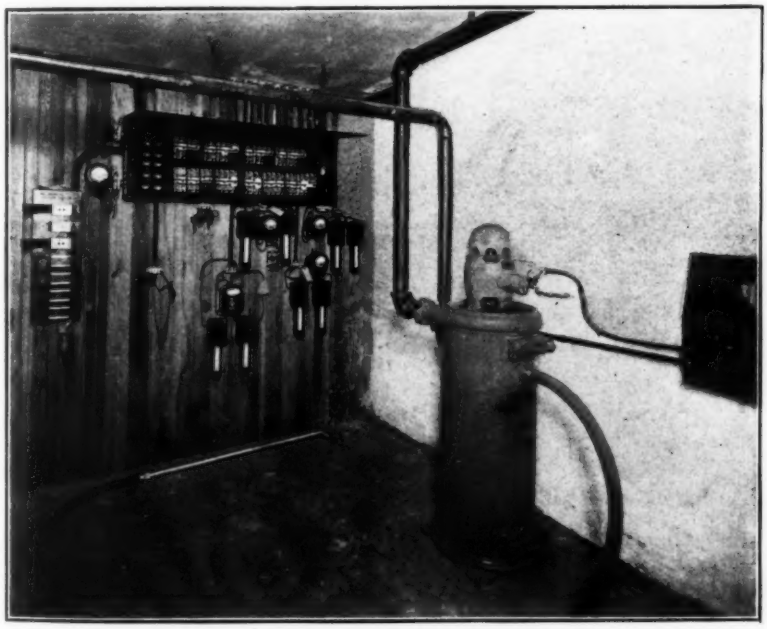


Fig. 3.—A Better Method of Connecting Meters and Placing Motor in Circuit.

Perhaps it should be explained that the doors to this cabinet—Fig. 3—close by gravity. The photograph was taken with the doors held open.

The vacuum cleaner, with the 0.8 horsepower, single-phase motor which drives it, is clearly shown. The suction pipe branches into two near the motor, and one branch extends to suction outlets in Section 1 of the building and the other to similar outlets in Section 2. The hose shown connected to the cleaner is used in cleaning rugs and the like which it may be desirable to bring into the basement room to be cleaned.

The small sheet-metal cabinet attached to the wall at the left of the cutout cabinet, and connected to it by means of a short, curved piece of conduit contains the connections for the vacuum-cleaner motor, and is an arrangement for this purpose which seems to be new. The box, which is four inches or so in depth, is closed permanently by means of machine screws. In the front side of it plates containing receptacles for attachment plugs are installed, there being one-plate and receptacle for the hallways and one for each of the apartments served. Over each receptacle a narrow iron door is fitted. The door is hinged at one end and provided with means for locking it with a padlock at the other. Two of these doors are shown open in Fig. 3. These doors are all numbered.

When the occupant of an apartment wishes to use the vacuum cleaner he unlocks the iron door protecting the receptacle having the same number as his apartment has, and inserts the plug seen on the right-hand side of the box. The motor switch shown in the extreme right-hand side of the figure is then closed. The motor then starts up, taking power only through the meter of the apartment in which the cleaner is being used.

Fig. 2 is a diagrammatic representation of the wiring between the motor and the attachment-plug connections. Suppose that connection is to be made for Apartment No. 1. The bottom receptacle is plugged into, and current flows over the wire marked *a*, say, through the plug connector, and back from the motor over wire *b*, the motor switch having been thrown upward in starting the machine.

A double-throw switch is used here because there is a second plug board like the one shown in Figs. 2 and 3, for making connections to the other group of apartments.

This arrangement for connecting up the vacuum cleaner was designed by A. Moberg, an electrical contractor of Chicago, who installed the electrical work in this building.

In the cutout cabinet in Fig. 3 there is a bell-ringing transformer to which all door bells and the like in the building are connected. No batteries at all are used for this service. The transformer, which is in an upper corner of the cabinet, cannot be seen.

Ground Connections for Electric Circuits and Apparatus.

It is exceedingly important in most cases where electric appliances or circuits are required to be grounded, that the ground connection be permanently good. To secure such a connection, however, is sometimes quite a difficult matter. The resistance between the earth plate and the earth should be as low as possible, and this quantity will vary as the condition of the soil varies. It will increase if the soil dries and the increase may be very rapid under the heating action of a heavy current to ground. The ordinary laws of resistance do not apply here; for the area of contact with the earth may be doubled without considerably reducing the resistance.

The inductance of an earth connection depends upon the length, number and arrangement of conductors employed.

Earth plates or pipes are more or less rapidly corroded by chemicals in the surrounding soil, the attack often being accelerated by electrolysis. The presence of electrolytic salts in the earth reduces the resistance to earth greatly, and where permanently damp soil cannot be reached, the ground should be moistened at intervals with an electrolytic solution.

Iron pipes one inch to two inches in diameter, and six feet or more in length make very effective earth contacts if driven into suitable soil. In order to avoid electrochemical action, the ground wire should be attached to this a few inches above the ground, and the joints should be as nearly perfect as possible. Where pipes cannot be driven the necessary depth, a number of metal strips radiating to form a sort of star may be buried as deeply as practicable, and used to make the contact with the ground. Wire netting has also been used where the strength of the current to ground was not likely to be great. Corrugated iron is sometimes employed, too.

The space around the earth conductor is generally filled with coke. If permanent moisture is not present, the coke should be saturated with sea salt, carbonate of soda or sodium chlorate. Sea salt gives the best results, and it is good practice to place a few handfuls of this, from time to time, in a basin formed for the purpose around the upper end of the earthing rod. A permanent basin formed of some suitable material and perforated to allow leakage may well be used.

For every earth conductor, there is a critical current above which the resistance of the ground contact rapidly rises if the current be sustained, the maximum current which a contact will carry without appreciable resistance to earth depending upon the contact surface and the quantity and nature of the moisture in the neighborhood.

In order to reduce the inductance of earth circuits, short bends and loops should be avoided as much as may be. Ordinary iron wire offers considerable impedance to high-frequency currents, but the impedance is much less if the wire is galvanized. Copper wire offers the minimum of impedance, and is more durable than iron wire.—*L'Industrie Electrique.*

Wiring Motor Stops.

A simple and handy way to wire for motor stops at some distance from the starting switch came within my experience a short time back. It is as follows: I connected two wires to the terminals of the no-voltage release magnet on the face of the starting box, and wired as for drop lights, having a rosette and cord drop at each point where a stop station was wanted. Instead of a socket on the cord I placed a Perkins pendant switch, fixed so that when the bottom button was pushed, contact was made but not held. When the pressure was released from the button the latter came back to normal no-contact position. This was accomplished by filing off the part of the arm on the side button which catches and holds the contact piece of bottom button.

Each station was wired in parallel as with lights. When a button is pushed the no-voltage magnet is short-circuited and the starting lever flies back to starting position.

H. Piccard.

WIRING FROM COMPENSATOR TO MOTOR.

By G. J. Leach.

In connecting up induction motors installed on floors instead of on ceilings or other elevations, it is not always a convenient matter to run the circuits between compensators and motors in the floor, nor under it. Moreover, open wiring on the ceiling, and from it down to the motor, may be objectionable from the standpoints of good appearance, permanency and safety. In cases of this sort, either one or the other of the two methods of construction shown in the accompanying figures may often be employed to advantage.

In Fig. 1 the starting compensator is mounted on the wall, and the conductors run from it to the motor in a line of conduit extending up the wall, along the ceiling, and thence down to the floor, the pipe being fastened to wall and ceiling by means of suitable cleats, and terminating at the bottom in a floor flange. At *C* the motor leads are brought out through a Type C condulet. The run of pipe from the ceiling to the floor should not be far enough from the motor to leave excessive lengths of wire exposed here.

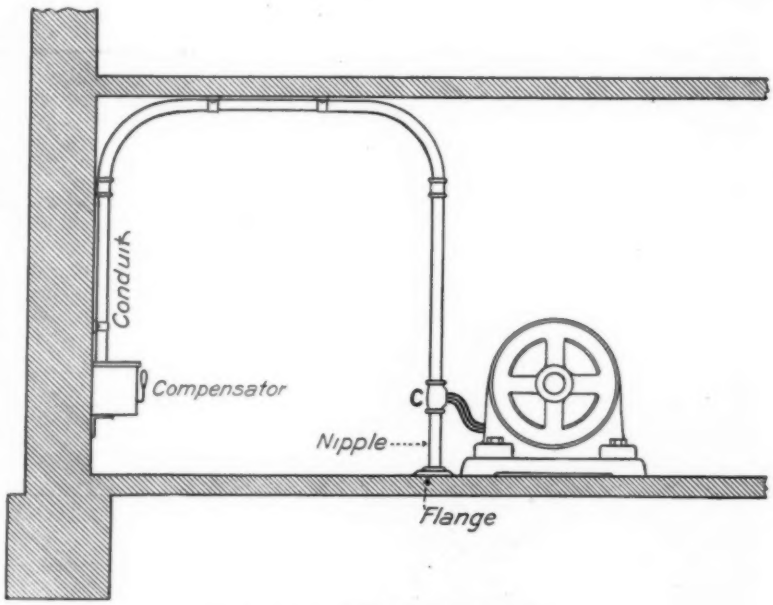


Fig. 1.—Proposed Method of Installation.

Figure 2 illustrates the construction in a place where there is an obstruction on the ceiling which interferes with running the pipe along it. Floor flanges are employed both at the ceiling and at the floor, and a tee fitting is used a T. I have found this method very handy.

The Contractor and the Central Station.

It is unfortunately a fact that relations between central station engineers and contractors are not yet satisfactory. It is true that during the last three years much has been done to clear away the misunderstandings which existed between them. But even now a certain friction exists in many places between those who instal the wiring and those who supply the current, which is harmful to the industry in general. The contractor is, as a rule, a purely business man with practical knowledge, and regards theoretical knowledge with suspicion. The station engineer is usually a man with exceptional knowledge of electricity, but he is not always a business man and is not always a practical man. Each regards things from a different standpoint: there is no common ground between them, and it is only quite recently that signs have appeared which seem to show that they are mutually recognizing the fact that their relations, instead of being antagonistic, should be co-operative.

That the feeling of mutual suspicion which still exists to some extent between the installation engineer and the supplier of energy is due to some such cause as that already mentioned, is shown by the fact that it exists in other countries as well as here at home. In the United States, for example, it has been pointed out, not once, but many times, that the contractor suffers because the central station engineer enters into the wiring field, competes against the contractor in both installation and repair work, and makes it part of his business to sell appliances for the use of electricity at such low rates as to render it impossible for the contractor, who has only his limited capital and not the funds of a large corporation or wealthy company to depend on, to compete against him.

Speaking on the subject a short time ago, a leading authority said that he presumed the central-station engineer justified such a policy because he desired to create a sale for electrical energy, and felt that the contractor could do little or nothing for them in this respect. He regarded this attitude as responsible for much of the bitterness which now prevails between these two branches of the electrical business, and felt that an opposite policy would be more conducive to the greater good for both. The greatest measure of success must depend on the prosperity of each, and the success of each must promote the interest of all, a principle which, it must be admitted, is beyond cavil.

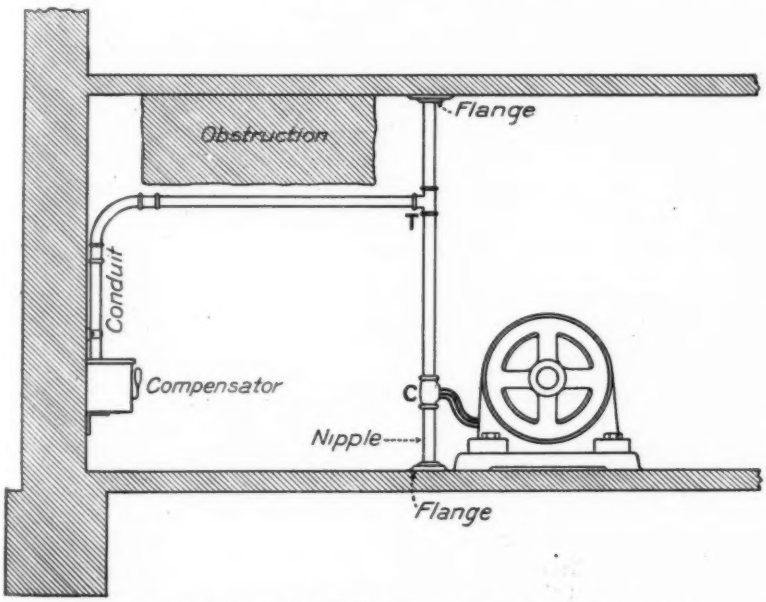


Fig. 2.—Modification of Method Shown on Preceding Page.

The most essential thing, he said, for the central station, is first to create a friendly public sentiment, and after having obtained it, to keep it. This requires the maximum of harmony and diplomacy, and to have this, every firm and individual engaged in the electrical business must be considered.

If the contractor is a competitor he is a disturber, and therefore, a source of irritation so far as his influence for or against the central station is concerned.

The central stations should do no construction work except on very small jobs where they come into close competition with the gas company and want to displace a gas arc or something of this nature. Then, solicitors should obtain house-wiring and other contracts and turn the work over to one or other of the local contractors, being careful not to show any partiality to anyone. In return for this consideration, the contractor should establish a schedule of prices for wiring houses and other small buildings that would be equitable to all concerned, and this schedule should be used by the central station solicitors in going after all work, as it would enable them to estimate almost any job quickly and intelligently, thus saving time and not arousing a suspicion in the mind of the prospective customer that someone is trying to rob him, as is too often the case when this co-operation is lacking and bids of various amounts are submitted. This schedule plan has been attempted in some quarters with more or less success and has attracted some attention by becoming the subject of comment in a congratulatory way by the electrical press in many parts of the country. By turning this business over to the contractors on this schedule plan, the central station would be enabled in a great degree to regulate this class of work. They have a record of the transaction, they maintain a uniform price, and thus secure justice to the consumer and the contractor secures his legitimate profit; the latter is therefore a satisfied "booster" instead of a thorn in the flesh to rankle and burn because he helps create a sentiment unfavorable to his natural ally.

The contractor in his turn should use his influence in every way to create satisfied customers for the central station, and it would be possible for him to allay much criticism that is unjustly directed at the central station. Too often the contractor takes a negative position, so far as the central station is concerned, in advising the customer to cut down his connected load and reduce his bills. It would be better for him to not emphasize a reduction of bills, and therefore less consumption of current and a reduction of profit to the lighting company, but instead to advocate more light. The customer is not so much concerned about the amount of his lighting bills as he is about the quality and quantity of the illumination he is getting for the money expended. A co-operative policy of this kind would do much to eliminate this source of annoyance, and the contractor would thus become a positive instead of a negative factor in his relation to the central station.

The central station could go further than this; they could make it possible for the contractor to purchase various heating devices, fans, fixtures, etc., at a cheaper price by combining their requirements, and thus put in such quan-

tities as would secure the minimum cost. This would enable them to mutually establish a re-sale price representing a fair margin of profit and everyone could sell the same article at the same time and at the same price; this, with simultaneous advertisng and window display, would yield better results. Another good feature of such an arrangement would be, one manufacturer's flat iron, toaster, heater, etc., could be used which would reduce the annoyance of the customer in procuring renewals occasioned by the use of many different brands of the same device. The possibilities in this line are almost limitless.

The central station should show consideration for the contractor by giving the latter a list of their prospective motor and apparatus customers, that all might be solicitors for the man who wants to sell his current. It should be impossible for anyone to sell any apparatus at cost or below retail prices, and the central stations should place themselves in a position not to do anything to reduce the contractor's profits or in any other way belittle him. The contractor would therefore have greater consideration for the central station, would exercise more care in not selling a customer a motor to use on a direct-current lighting circuit, when he ought to have an alternating-current motor, or a 60-cycle motor when he should purchase a 30-cycle; or a three-phase motor for a single-phase circuit, etc. All these cause great dissatisfaction and irritation and may be reduced to a minimum.

This policy would give the central station a restraining power that no other policy could possibly give. If the contractor is tempted to introduce and push the sale of some new device or product that for some technical, engineering, or other reason the central station deems inadvisable to adopt, the fact that this co-operation is so beneficial in its results would restrain the contractor from yielding to any temptation that would embarrass his ally and friend.

The foregoing and many other things growing out of this policy must appeal to the central-station man who wishes to exercise some regulation over the prices, sales and methods of associated interests affecting public opinion and the sale of his product, as he wants the best results and can obtain them in no other way. It must appeal to the contractor because it is his bread and butter; it is his chance to associate with larger interests, to develop greater business and larger business capacity.

Moreover, it is not only the ideal relation, but in the light of the best knowledge of this generation, it is the only relation that will give these kindred interests their full degree of development.

It has been suggested that supply stations should not carry out wiring themselves, but should exercise control over the installation work in the area which they supply.

This sort of a plan would almost certainly be unworkable in practice. The contractor would resent, and rightly, any interference with the work which he was carrying out in a fit and proper manner. The mere suggestion that such control was needed would be sufficient to cause friction between the contractors in a district and the supply authority.

But there is no need for such suggestions to be made. The contractor is a most reasonable man, and provided no attempts are made to cut into his trade, take away a part of his livelihood, or dub him, as has been done at times—incompetent, ignorant, and even unscrupulous—he is prepared to do his part to assist the central station in its efforts to popularize the use of electricity.

It is rather too frequently forgotten that the contractor has in the past been the best friend of the supply station; that it is due to his energetic canvassing his painstaking work, that customers have been connected to the mains. And it is with pleasure that one sees it becoming evident that the most clear-headed sation engineers fully realize that the presence of a friendly, businesslike contractor in a district is a great advantage to the supply authority, and one which they would not willingly forego.—*The Electrical Manufacturer and Installation Engineer.* (London.)

Lubricating Dynamo and Motor Brushes.

A method in use at the power house here, and which has proven eminently satisfactory, consists in removing a single set of brushes from the machine, suspending them in a bucket of boiling vaseline and continuing the process for four hours. When removed the vaseline should be as hot as possible in order that the brushes may drain properly and not have a coating of the vaseline on the surface when cool.

It will be found that treating the brushes from a single set of brush holders will result in the efficient lubrication of the entire commutator.

Frank M. J. Murphy.

It is stated that a card in a Boston Power House reads: "To touch these wires means instant death! Anyone failing to respect this warning will be prosecuted and fined."

Among the Contractors.

The Cuthbert Electrical Manufacturing Company, 729 Fulton Street, Chicago, is installing electric wiring for 900 incandescent lamps in the Chase Apartments in this city.

The Ballentine-Clarke Company, electrical contractors, of Seattle, Wash., moved on June 1 from 1928 Madison Street to 1017 Western Avenue, in that city.

Henry Newgard & Company, 947 Washington Boulevard, Chicago, are installing 1,000 incandescent lamps and 4 motors for the Franklin Company, at 718 South Dearborn Street, Chicago.

Hawkins & Haywood, electrical contractors, of Victoria, B. C., have moved into larger quarters at 1607 Douglas street, where a complete stock of supplies and fixtures will be carried. This company is installing the electrical work in the new seven-story St. James Hotel in Victoria.

J. L. Burgard, 5448 South Halsted Street, Chicago, is wiring for 600 incandescent lamps in a building erected by J. Seabury on Leland Avenue, Chicago.

The Columbia Electric Company, of Seattle, Wash., which has just Completed the cluster-light installation on the Great Northern Railroad bridge in Seattle, is also doing the electrical work on the new building to be occupied by the Lozier Motor Car Company. This company is also completing the electrical work in the Trinity Methodist Episcopal Church in Bellingham, Wash.

The James Clark, Jr., Electric Company, of Louisville, recently used a window display showing the use of electrical appliances in the office and the home. A feature of the display, which attracted much attention, was the use of a cutout of an unusual kind, which depicted a young woman of attractive appearance using a flat iron, the lower part of the board being turned down to represent the ironing-board. The unusual feature was that instead of an illustration of the iron being used in the display, the real article was installed, the cutout being made so as to enable this to be done. The effect was very much better than otherwise would have been the case. Office furniture secured for the purpose was also installed in the window, and the telephone brackets, electric fans and other devices placed on the desk were set off to good advantage.

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Executive Committee:

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Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, Wm. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, Thos. Henry Day, James E. Cole, Thos. D. McColl

Secretary's Message.

The summer season is now on and those of us who can get away are planning to do so, or already have. The Secretary wishes each and all a pleasant vacation, but as to the nature of the same expresses no wish, other than that it may be in complete harmony with each individual taste. Personally, he has retired to the Maine Woods, to a very comfortable, though small, log camp on the edge of a mountain lake which, with the tributary streams, supplies trout and landlocked salmon fishing that is not to be "sneezed at." To this sport he proposes to apply himself for a while, interspersed with periods of exercise of parental influence over three healthy youths of eleven, nine and six, respectively, and one small girl of five, who may at any time be found either standing on her head on the end of the canoe float or clinging half way up the face of the ledge behind the camp in an heroic attempt to equal or out-do her brothers.

In spite of this, however, he will have plenty of time to attend to the hungry cries of the members of the Executive Committee for Questions to answer in this department, and, in order that the usual repast may be furnished for their consumption again, most earnestly requests that *questions be sent him, and sent promptly.*

Please take notice that K. W. Adkins' address should be changed to read, Missouri Actuarial Bureau, Waldstein Building, Kansas City, Mo.

As to the questions answered in this number, No. 189 requires no comment. No. 190 suggests one or two things which may be noticed. The second answer to this speaks of "attics which are not accessible by means of a scuttle or trapdoor." The Secretary is very strongly of the opinion that these are very bad places for wiring, not only in view of the cases where changes or repairs may be needed, but because they develop hot-air pockets under the roof with consequent added liability of fire; or, again, after a dry spell with a shrinkage in the shingle roof, leaks may develop and the wires be damaged by water from rains. There are other reasons, also, in view of which he has always, so far as possible, exerted influence to have a trap or opening left large enough to get in through, though it may be made small enough to prevent the convenient use of the space for storage. It may sometime mean a great deal to be able to get a hose nozzle in without having to cut through a partition.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

The gentleman who wrote Answer 8 apparently was misled by a superfluous word in the question which I thought I struck out but probably failed to do in his case. The question originally read "on the under side of the rafters" the word *under* being misleading. The rafter has an under *edge* but the question did not mean knobbing down this two-inch edge, but down the side as in the diagram. It is clear, of course, that the answer is correct as to the use of the edge.

Concerning Brass-Shell Key Sockets on Exposed-Conduit Fittings.

Question 189. A brass-shell key socket is mounted on an exposed-conduit fitting with a porcelain cover and brass nipple, wired with No. 18 fixture wire. Does this conform to Rule 30*a* of the 1911 Code?

Answer 1. Yes.

Answer 2. No.

Answer 3. Referring to Rule 30*a*, the size of the wire used is of no consequence, as this case does not come under the last part of Paragraph 1, which contemplates the use of sockets of a different design from the brass-shell type, and the entire omission of the insulating joint. The given case is rather a question whether the porcelain cover of conduit fitting can be treated as an approved insulating joint. I should accept it as the equivalent, to all intents and purposes.

Answer 4. The use of fixture wire and the brass-shell socket would necessitate the installation of an insulating joint, and the porcelain cover on the condulet could not be considered as taking the place of the insulating joint, on account of mechanical strength if for no other reason.

Answer 5. Yes. The porcelain cover is the equivalent of an insulating joint in a fixture.

Answer 6. Yes, when a porcelain cover is used.

Answer 7. A brass-shell socket mounted on an approved porcelain condulet cover or box cover complies with the intent of Rule 30*a*, provided the fixture wire used to supply the socket has its insulation so reinforced within the grounded fitting that it will be the equivalent of the insulation on the conduit wires.

Answer 8. Yes. A porcelain cover acts as an insulating joint.

Answer 9. I do not think that this can be answered definitely either yes or no, for the following reasons: 1. They are not mentioned in the list of approved fittings anywhere in connection with "insulating joints." They are referred to in connection with "receptacles." 2. Porcelain is brittle and liable to snap under strain, and then it has a sharp cutting edge often times. 3. Rule 76, "insulating joints" does not very distinctly suggest porcelain. Rule 72*p*, fine-print note, says "Porcelain-shell sockets being subject to breakage and constituting a hazard when broken will not be accepted for use in places where they would be exposed to hard usage."

Now it is obvious that the indicated combination is not directly referred to anywhere but that it has both advantages and limitations. If the place where it was to be used was clearly one where it would be extremely unlikely that the fitting would be disturbed, I think I would approve it. On the other hand unless this were clearly the case I would not accept fixture wire but would require No. 14 conduit wire, and a nipple and socket large enough to accommodate the same. That is, the porcelain cap is the equivalent of an insulating joint in so far that it thoroughly destroys the conductivity of the point of insertion; but it is in no way the equivalent of one considering tensile strength or capability to resist injury.

I think the use of fixture wire in such a place is distinctly to be discouraged.

Wiring on Rafters in Unfinished Attics.

Question 190. The Code calls wiring in unfinished attics "concealed wiring" and prohibits wires being placed on the tops of the joists or collar beams as I understand it, thus requiring wires to be installed in tubes the same as in any floor joists when crossing the joists. Why cannot the main wires be placed on knobs on the side of the rafters, branches running down between the rafters and dropping short distances to the lower edges of the joists, near the eaves and out between these to the outlet points in the ceiling below? Where is this prohibited, and why?

Answer 1. The construction described in this question might be approved if the wires running on the rafters were protected from mechanical injury by means of boxing, or boards placed to prevent material being thrown against them.

Answer 2. The method of wiring unfinished attics as outlined may be considered as a safe installation where attics are not accessible by means of a scuttle or trapdoor. It has been the experience of this territory that where attics are accessible, in course of time they are filled up or found to contain a large amount of discarded material, this being stored without any respect to the damage to the wiring installation.

Answer 3. Code Rule 26*f* declares that wires in unfinished attics are considered as exposed to mechanical injury; and, in consequence, Rule 26*e* requires that they must be suitably protected. The methods of protection specified indicate that overhead wiring is referred to, but I do not see in this any prohibition of the running of wires between or through joists under an unfinished attic, provided they are properly protected from injury. In such a case we require that floor boards be securely nailed in position above the wires.

Answer 4. We permit wires to be knobbed on the under side of roof rafters, but where they run down to outlets they must be knobbed on the sides of the rafters to the point where the rafters meet the joists and then knobbed on the sides of the joists; or they may be brought down knobbed on sides of perpendicular boards at least one by three inches in cross-section.

Answer 5. If the wires are run on running boards or protected by guard strips, they may be run on the under side of the rafters and still be within the requirements of the rule. Wires thus installed and protected will not be subjected to mechanical injury incident to storing things on the wires.

Answer 6. All attics are subjected to the storage of household sundries, and practice has proven that open wiring is subject to mechanical injury and disarrangement due to the storage. So wiring in unfinished attics which are accessible, should be protected from mechanical injury, and especially so near the eaves, as this particular point offers special inducements to store bed springs and other metal parts pertaining to beds, etc. See Rule 26*e*.

Answer 7. Rule 26*f*, second paragraph, was recently reworded expressly to permit the class of work described by the questioner. Care should be taken in this construction, however, to protect the wires from mechanical injury between the last supports on the rafters and first supports on the joists.

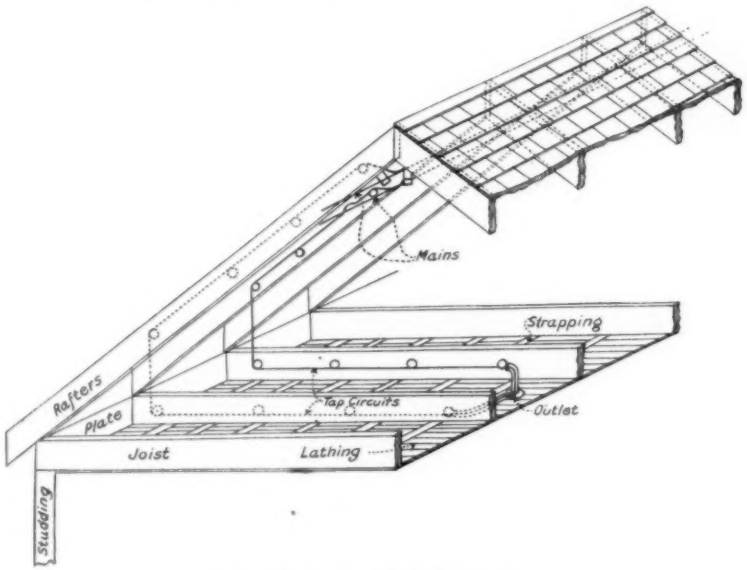


Diagram Illustrating Question No. 190.

Answer 8. Rule 26*f*, relating to wiring in unfinished attics, states: 1. That they are considered as exposed to mechanical injury. 2. That they must not be run on knobs or the upper edges of joists.

Since the rule considers all wires in unfinished attics as exposed to mechanical injury, although it specifies only one way of avoiding same, I should rule that the plan suggested of running wires down on the under side of rafters, etc., is prohibited by the first and more general half of the paragraph in question.

Answer 9. This type of wiring is clearly permissible under Rule 26*f*.

The wires running along the rafters should have a running board behind them and should be well up toward the ridge so as to prevent them from being used like a clothes line.

It is rather better to run down between the rafters till one is within the protection of the floor joists, but occasionally one cannot do this on account of peculiar construction at the eaves.

In this case it is all right to drop from rafter to joist a little way out from the line of intersection, but it should be as short a drop as possible, and it is well to take a piece of "strapping" and firmly spike it edgewise to rafter and joist in front of the vertical wire so as to protect it.

I think that this is distinctly better than running at right angles to the floor joists and boring them, unless broad floor boards are placed above each run.

Public Service Commissions

WISCONSIN.

The Wisconsin Railroad Commission has issued an order authorizing the Farmers' Telephone Company, of Richland Center, to increase its tolls and charges. The investigation revealed the fact that, if a reasonable allowance were made for depreciation, there would still remain a considerable deficit to be overcome before anything could be available for interest on the investment. The company has been furnishing free switching service to rural and toll lines owned by other companies. In the Commission's opinion this practice is a discrimination and should be made to yield sufficient revenue to compensate for the costs incurred. The new rates as ordered by the Commission include a charge for switching based upon the proportionate cost of this service. The rates for local residence and business 'phones were ordered increased 25 cents per month. The Commission also condemned the practice of supplying both residence and business service on the same two-party line, and this practice was ordered abolished.

The Commission also partially granted the application of the Brodhead Telephone Company for an increase in rates. An analysis of operating expenses and revenues showed that no increase was imperative, as the utility is now earning over 8 per cent on its present valuation, besides allowing for a 6.5 per cent depreciation fund. But the Commission considered that the relatively low operating costs of the past few years could not long continue and that consequently no decrease in earnings could be justified. The company has been furnishing single-party service only and has about reached the limit of its equipment. To avoid the expenditures which would soon be necessary for additional equipment, the Commission ordered the utility to provide for a two-party residence service. In order to allow for a reasonable difference between single-party and two-party rates and at the same time not to decrease the company's revenues, the single-party residence rate was increased 25 cents per month and the two-party rate made the same as the old single-party rate. On the basis of past operating expenses the new rates will yield an estimated return of about 10 per cent on the present value of the property. The petitioner desired to install a four-party service, but the Commission did not consider it advisable and refused the request.

The Commission has handed down its decision in the application of the City of Rhinelander for an order requiring the Rhinelander Lighting Company to decrease its rates and charges. The petition alleges that the present rates are excessive and discriminatory. In arriving at a valuation to be used as a basis for rates, the defendant contended that an allowance of about $73,000 in excess of the physical valuation should be made for intangible values. It appears that according to the terms of the franchise which the company received from the city, the utility agreed to light the public buildings free of charge, and it was contended that the total cost of this free service throughout the life of the plant should represent the franchise value. This claim was not allowed, in as much as the surrender of the franchise for an indeterminate permit acted to invalidate all provisions incident to the grant of the original franchise.

The utility, some years ago, contracted with the Rhinelander Power Company for the purchase of electric power and therewith abandoned its steam power plant. In as much as a considerable saving was effected by this change, the utility contended that its contract with the water-power company had a value which ought to be included in the total valuation. In commenting upon this claim, the Commission says: "While calculation of the saving produced by the use of water power instead of steam power are of much importance in private and public undertakings in showing the financial feasibility of hydraulic construction, the title of the owners in a utility business to the entire savings so produced has not been clearly demonstrated. Indeed, the respondent's claims seem to go so far as to preclude the public from any share in economical methods of service and seem to place upon the users of utility service the burden of maximum costs of production. That this principle may be followed in the determination of rates that are equitable to the public and the utility appears to be very doubtful, as it results in costs that are not dependent upon reasonable efficiency, normal investments and local advantages to which the community lends value, and sets up, as a standard and test, methods of operation which are most costly and least efficient."

Upon the basis of the unit costs of service, the following rate schedule was arrived at: primary rate of 10 cents net per kilowatt-hour for the first thirty hours' use per month of the active connected load; a secondary rate of 7 cents per kilowatt-hour for the next sixty hours' use of the active connected load, and an excess rate of 4 cents net per kilowatt-hour. In Class A, consisting of residences, when the total connected load is equal to or less than 500 watts, 60 per cent of such connected load is to be considered active; when the installation exceeds 500 watts, one-third of such excess is to be deemed active. In Class B, consisting of stores, business and professional places, etc., when the total connected load is equal to or less than 2,500 watts, 70 per cent of such installation is to be deemed active; when the installation exceeds this value, 55 per cent of the excess is to be considered active. In Class C, consist-

ing of public buildings, industrial establishments, etc., 55 per cent of the connected load is to be active.

The schedule for power service is as follows: a service charge of $1.00 per month for each installation of one horsepower or less, 75 cents for each additional horsepower up to 5 horsepower, and 50 cents per horsepower for each additional horsepower over five; a meter rate of 3 cents net per kilowatt-hour for the first ninety hours' use per month of the total installation and a rate of 2 cents per kilowatt-hour for additional energy.

According to the terms of its contract with the water-power company, the defendant cannot furnish power service. The Commission's order provides that either the utility or the water-power company must furnish this service. According to the terms of the Commission's order, the utility must install meters for all of its consumers within ninety days from the date of the order.

The Commission has authorized the Milwaukee Electric Railway & Light Company to issue $3,000,000 of general and refunding 5 per cent mortgage bonds. This issue is authorized to enable the company to pay an outstanding indebtedness incurred by reason of additions made to its property from December 31, 1911, to March 31, 1912, and for making further extensions.

NEW YORK.

The Public Service Commission for the First District made public last week the report of the Bureau of Gas and Electricity, showing the number of gas and electric meters tested during the month of June, 1912. There were 30,023 gas meters tested, of which 216 were tested on complaint of consumers, 4,402 were new meters and 22,405 were repaired and removed meters; 52 electric meters were tested on complaint. Of the gas meters tested on complaint, 13.4 per cent were found to be correct, 46 per cent were found to be fast and 40.6 per cent were found to be slow. Of the electric meters, 11.5 per cent were found to be more than 4 per cent fast, 2 per cent were found to be more than 4 per cent slow and 86.5 per cent were found to be within the limits of tolerance.

The Public Service Commission, Second District, has ordered the New York Telephone Company to discontinue the use of the word "telegram" as a call word for the Western Union Telegraph Company or for any other telegraph company within this state. The New York Telephone Company is directed and required to assign to the Postal Telegraph-Cable Company and Western Union Telegraph Company call numbers as is usual with other subscribers to its service, and that in addition thereto the word "Postal" be assigned as a call word for the Postal Telegraph-Cable Company and the words "Western Union" be assigned as a call word for the Western Union Telegraph Company. The call word for each company is directed to be printed in the subscribers' directories of the telephone company hereafter issued in such manner and with such explanation as to show clearly that a person desiring to send a telegram over the lines of the Postal Telegraph-Cable Company may call that company by the use of the single word "Postal" and that a person desiring to send a telegram over the lines of the Western Union Telegraph Company may call the company by the use of the words "Western Union." The telephone company is required to make a rule for the government of its switchboard operators that in no case shall the word "Telegram" be recognized as a call word, and that if such word be used the operator shall at once inform the person calling that it is not recognized as a call and that the operator must require the person calling to use a proper call word. The order further provides that in no case of call for telegraph connection shall any employee or switchboard operator of the telephone company be permitted or allowed to designate, direct or advise which telegraph company shall be called for the purpose of sending a telegram, subject, however, to the provision that where the exchange has direct connection with but one company, the operator may advise the person calling what company is connected with that particular exchange. The New York Telephone Company is required to notify the Commission on or before July 22 whether the terms of the order are accepted and will be obeyed. The making of this order followed the filing of a complaint by the Postal Telegraph-Cable Company, alleging that the use of the word "Telegram" as a call word operated to a disadvantage of the Postal Company, and that the practice was unjust, unreasonable and discriminatory to it. The resolution of the Commission recites that the evidence given satisfied the Commission that the use of the word "Telegram" as a call word is unjust, unreasonable and discriminatory as against the Postal Telegraph-Cable Company.

The Commission has received notice that the New York Telephone Company has purchased the physical property and business of the Onondaga Independent Telephone Company for the sum of $700,000.

The Commission has been notified that the Southern Cayuga Telephone Company has been merged with the Cayuga Southern Telephone Company. The Cayuga Southern Telephone Company now owns all of the stock of the Southern Cayuga Telephone Company.

Alleged discrimination in the furnishing of electric service by the Murray Electric Light & Power Company in Monticello is complained of to the Commission by Frank H. Osborne. He claims that his repeated applications to the company for current for his garage to operate his vulcanizing plant and other machinery have not been acted upon, while for some time past the company has supplied like service to two other garages in Monticello. Last year, it is stated, the company wired complainant's garage, but has since that time refused to supply him with energy, notwithstanding his willingness to bear part of the cost of connecting his plant with the company's power line.

The Commission has authorized the Katonah Lighting Company, operating at Katonah and Bedford, Westchester County, to execute a mortgage upon all its property, rights and franchises to secure the payment of 30-year six per cent bonds amounting to $125,000. The company is authorized presently to issue bonds to the amount of $75,000 to be sold at not less than par, the proceeds to be used for the payment of construction of its new steam plant and extensions to South Salem, Poundridge and Bedford and to discharge the lawful capitalizable obligations of the company.

The Commission has granted a certificate of public convenience and of necessity to the Little Falls & Johnstown Railroad Company. The company proposed to build a double-track electric railroad in Johnstown via St. Johnsville to the city of Little Falls with a branch from a point in the village of St. Johnsville through the village of Nelliston and Fort Plain to the village of Canajoharie.

The Commission has authorized the Cayadutta Generating Company to execute and deliver to the Albany Trust Company a mortgage which will secure an issue of 30-year five per cent bonds to the amount of $50,000. The company is authorized to issue presently bonds to the amount of $30,000 to be sold at not less than 90, the proceeds to be used for additions and betterments to the plant for the purchase of a building. The company operates in Fonda and Fultonville, Montgomery County.

The Commission has authorized F. J. Auburn to exercise a franchise in the town of Cicero for the furnishing of electricity to the unincorporated village of Cicero, Onondaga County.

The Commission has authorized the Buffalo General Electric Company to exercise franchises granted for the fur-

nishing of electricity to the village of Kenmore, Erie County.

The Commission has authorized the Montgomery Electric Light & Power Company to construct a transmission line from the village of Canajoharie to the village of Sharon Springs and to exercise a franchise for the furnishing of electricity in Sharon Springs.

Large Coal Tonnage Mined in Montana.

Owing to the great activity which is now manifest in the Bull Mountain coal field, Musselshell County, Mont., the United States Geological Survey has made a careful estimate of the amount of coal in that field to supplement its geologic reports published in Bulletins 381 and 431. According to the present figures, the field originally contained in beds 14 inches or more in thickness 4,797,200,000 short tons of coal. A small part of this quantity has already been mined, but by comparison with the total coal content the amount removed is almost negligible.

In using these figures given above it should be remembered, however, that they are intended to include all the coal contained in this field and no allowance has been made for waste in mining. According to the present mining practice throughout the country probably only 60 per cent of the total coal in the ground is put upon the market, but it is hoped that in the future greater care and more efficient methods will enable the operators to recover a larger percentage, if not the total amount.

Among the Supply Men

B. C. Hubbard, formerly of the Electric Appliance Company, is now covering the northern New York territory of the Syracuse Supply Company, Syracuse, N. Y., and J. E. Fern, formerly with the Adams-Bagnall Electric Company, is now representing the Syracuse Supply Company in northern Pennsylvania. H. B. Scott, manager of the company, reports that business in New York State is normal, but that it does not equal the business done in 1907. He also reports a brisk demand for household heating devices.

E. A. Nelson, formerly owner and manager of the Mutual Electric Company, of Duluth, has associated himself with the Richardson Electric Company in the capacity of superintendent of construction. The company has recently secured the following contracts: 90-kilovolt-ampere, 1,100-volt, single-phase generator, together with switchboard and installation for the Consolidated Elevator Company at Duluth; 48-kilovolt-ampere, 60-cycle, three-phase, 480-volt generator with switchboard and installation, also wiring for lights in the mills of the Itasca Paper Company at Grand Rapids, Minn.; extensive alterations to the electrical equipment for the American Milling Company at Superior, Wis., and similar alterations for the Reiss Coal Company at its coal dock at Superior.

J. M. Hannaford, Jr., manager of the publicity department of the Northwestern Electric Equipment Company, St. Paul, Minn., reports that it is conducting a special campaign on "Hot-Point" irons through the medium of its monthly bulletin, entitled "The Northwestern Buzzer." This campaign is producing very good results not only in the sale of "Hot-Point" irons, but it is also a stimulus to the trade in general. They also report that crops in the northwestern territory are away above average, and they look forward to very good business in the fall if they meet with no serious setbacks.

The Cohn Electric Company, of Shreveport, La., has been experiencing a great demand for residence wiring lately, largely due to a wiring campaign conducted by the Shreveport Gas, Electric Light & Power Company. Through the efforts of J. E. Cowles, superintendent of the light company, and J. A. Baker, wiring solicitor for the same company, they have secured many new customers. The Cohn Electric Company has a contract with the lighting company to do all its inside wiring, and practically all of the houses of Shreveport have been wired. The Cohn Electric Company is also installing a modern light plant at Gas Center, La., for the Purified Petroleum Produce Company, which is installing one of the largest and best equipped refineries in the South.

C. J. Litscher Electric Company, Grand Rapids, Mich., reports that Grand Rapids is installing a boulevard lighting system, as is also the village of Lowell, Mich. The Litscher company succeeded in securing the order for both contracts for Luxolabra standards manufactured by the Adams-Bagnall Electric Company, of Cleveland. Grand Rapids is installing 150 standards and Lowell, 50.

David Aitken, general manager of the George Worthington Company, Cleveland, Ohio, reports a sales convention impending. The company has just let a contract for a 66 by 90 five-story concrete warehouse, which will make additional room for the electrical department. The salesmen report a normal business, and the company is not experiencing any unusual demands. Sales campaigns are being conducted on heating devices, electric fans, and electric vacuum cleaners.

Oscar Turner, president of the Southern Wesco Supply Company, Birmingham, Ala., reports fair business with good prospects for the immediate future. The company is pushing Wesco telephones and is anticipating a big fan season. This company handles Wesco, Trojan, Peerless and Ilg fans. An automobile-accessory department has been opened recently with a brisk business.

The Gee Electric Company, Wheeling, W. Va., has been conducting a special sales campaign for the past year to extend the business of its repair and manufacturing departments. They report that the sale of commutators and assembled commutator segments, and the general repair work have grown so steadily that although their plant capacity has been materially increased during the past year, they are now contemplating further extensions.

The Manhattan Electrical Supply Company, Chicago, reports that the recent hot spell has stimulated the demand for electric fans and conditions are favorable for equalling the sales record established last summer.

John Blessing has started an electrical supply house in Fennimore, Wis.

Legal Notes

THE LAW OF THE THEFT OF GAS AND ELECTRICITY.[1]

By H. L. Geisse.

The statute books of nearly every state in the Union contain some legislative enactments for the punishment of persons who seek to defraud vendors of gas or electricity by diverting those commodities from the conduit pipes or wires without passing through the meter. These statutes are diverse and various in their wording, but the essential features of them are practically uniform in significance. The statute of the state of Texas (article 1256, White's Penal Code, 1911) may be considered fairly typical. It is as follows:

"That whoever intentionally, by any means or device, prevents electric current, water or gas, from passing through any meter or meters belonging to a person, corporation, or company, engaged in the manufacture or sale of electricity, water or gas, for lighting, power or other purposes, furnished such person to register the current of electricity, water, or gas, passing through meters; or intentionally prevents a meter from duly registering the quantity of electricity, water or gas, supplied or in any way interferes with its proper action or just registration or without the consent of such person, corporation, or company, intentionally diverts any electric current from any wire or water or gas from any pipe or pipes of such person, corporation, or company, or otherwise, intentionally uses or causes to be used without the consent of such person, corporation, or company, any electricity, or gas manufactured, or water produced or distributed by such person, corporation, or company, shall for every such offense be punished by a fine of not less than $25 and not more than $100. Every person, firm, or corporation engaged in the business referred to in this act shall keep displayed at all times, in a conspicuous place in their office, a printed copy of this act."

It is to be noticed that this statute has in contemplation provision for punishment of several different methods of defrauding sellers of current or gas.

(1) Provision is made against the prevention of current passing through a meter by any device.

(2) Provision is made for punishment on the altering of meters so that they do not register correctly.

(3) There is provision for the offender who taps a wire or main.

(4) The statute affords punishment for one who uses or causes to be used gas or current thus stolen.

Similar statutes of other states provide also for punishment of persons injuring in any way the equipment of gas or electric manufacturers; some states provide punishment for persons who aid, abet or assist in making the connections or instruments or devices for diverting gas or electric current; some states have provision that merely making the connection or merely devising the instrument for diverting the gas or electricity shall be punishable, and some statutes prescribe what evidence shall be necessary to secure a conviction of a person accused of stealing current or gas. One state, Connecticut, specifically mentions in its statute the robbing of prepayment meters as an offense made punishable thereunder.

The punishment designated by the different statutes varies from the light fine designated by the Texas statute to a fine of $1,000, or one year in the penitentiary, or both. In some states a very heavy sentence is imposed on an offender who breaks or destroys any equipment of a gas or electric company. In Vermont the punishment for this offense is five years in the penitentiary. Several states have a provision that nothing in the penal statute shall be considered as interfering with the right of the manufacturer of gas or electricity to recover in an independent civil action for the current or gas of which it has been defrauded. This provision is made in Idaho, New Jersey and Vermont.

As an illustration of a simple, direct, yet inclusive enactment, reference might be made to the statute of the state of Washington. It is as follows:

"Every person who, with intent to injure or defraud, shall,

"(1) Break or deface the seal of any gas, electric, steam or water meter;

"(2) Obstruct, alter, injure or prevent the action of any meter or other instrument used to measure or register the quantity of gas, electricity, steam or water supplied to the consumer thereof;

"(3) Make any connection by means of a wire, pipe, conduit, or otherwise, with any wire, main or pipe used for the delivery of gas, electricity, steam or water to the consumer thereof, in such manner as to take gas, electricity, steam or water from said wire, main or pipe, without its passage through the meter or other instrument provided for registering the amount or quantity consumed, or use any gas, electricity, steam or water so obtained, or,

"(4) Make any connection or reconnection with such wire, main, or pipe, or turn on or off or in any manner interfere with any valve, stopcock, or other appliances connected therewith, or,

"(5) Prevent by the erection of any device or construction, or by any other means free access to any meter or other instrument for registering or measuring the amount of gas, electricity, steam or water consumed or interfere with, obstruct or prevent by any means, the reading or inspection of such meter or instrument by the person, company, or corporation owning the same, shall be guilty of a misdemeanor and shall be punished by a fine of not more than $250 or imprisonment in jail not over ninety days, or both."

An examination of the books discloses few cases arising under any of these statutes. It is to be inferred that the companies have connived at known cases of theft rather than risk a public prosecution and the resulting suggestion to other persons. The courts have been called upon, however, to decide questions pertaining to the theft of gas and water not arising under the statutes. The principles enunciated in these decisions are important.

There can be no doubt of the right of a company to cut off the service of a consumer whom it finds to be stealing its product. This is a necessary deduction from the decisions that hold that a company may cut off the

[1] Paper read at convention of the Southwestern Electrical and Gas Association.

service of anyone who refuses to comply with the reasonable regulations of the company. It appears, however, that if the company is to take advantage of this right, it must do so promptly after the discovery of the theft, and that a continuance of the service for any extended period of time, and the entering into new contracts to supply the consumer with current or gas, will act as a waiver of the right of the company to refuse the customer service.—Gardner vs. Springfield Gas & Electric, 135 S. W., 1003.

In reviewing the statutes it is apparent that in some states the penalty provided is so light as to be of little dread to the hardened swindler. Peculation of current or gas may be so cleverly carried out that months or years will elapse without their being discovered. In such case a light fine, such as the Texas statute provides, is grossly incommensurate with the gravity of the offense. But it has been held that the state is not confined to prosecution under the specific statute, but may prosecute the offender generally for the crime of larceny or theft.—Woods vs. the People, 222 Ill., 293, 78 N. E. 607.

The defendant in this case endeavored to set up that the offense made out against him was properly punishable under the special statute referring to the diversion of gas, and not under the statute punishing larceny. The court said that the section of the statutes referring to abstracting gas from the pipes of a gas company, was passed with a view of protecting water, gas and electric meters from being tampered with, or making false connections with the lines or pipes, so that gas or electricity might be consumed without passing through the meter; that the crime of larceny and the crime created by the statute were entirely separate and distinct offenses, and that the evidence which would support a conviction in one would not even tend to show the defendant guilty of the other; therefore, a conviction of larceny would stand. That gas is subject of larceny has long been considered well settled. (Commonwealth vs. Shaw, 4 Allen (Mass.) 308; 81 Amer., Dec. 706. State vs. Wellman, 34 Minn., 221, 25 N. W., 395. Regina vs. White, 6 Cox's Criminal Cases, 213), and the same could be said of electricity. Both are valuable articles of merchandise, bought and sold like other personal property, susceptible of being severed from a mass or larger quantity, and of being transported from place to place. To constitute larceny it is sufficient for it to be proved that the accused passed the gas around his meter in any way so as to cause it to escape registration. (Bishop on Criminal Law, 7th Edition, page 799.) The question arises as to whether the theft of gas or current shall be considered a continued act during all the time the irregular connection existed, or as a separate act each time the lights or the gas were turned on. This is important, for if each act be considered a separate offense, the defendant may be guilty of a series of misdemeanors, punishable by a fine or jail sentence, while if he be held accountable for the sum total of the gas or electricity consumed, his crime may amount to a felony, punishable by a penitentiary sentence. It is the rule that while the pipe or wiring device remains connected, the offense is considered one continuing act (Queen vs. Firth, L. R., 1 C. C., 172. Regina vs. Bleasdale, 2 Car. & K., 765. Queen vs. Shepherd, L. R., 1 C. C., 118. State vs. Wellman, 25 N. W. (Minn.), 295. Commonwealth vs. Shaw, 81 Amer., Dec., 706. State vs. Martin, 72 North Carolina, 672.)

In fixing the value of the gas or current stolen, the law is that the selling, and not the cost, price of the commodity shall be considered in determining the degree of the crime (Wood vs. People, 222 Ill., 293; 78 N. E., 607). A recital of the facts and holdings of one or two of the most important cases may be interesting.

In State vs. Wellman, Minnesota case, the defendant was a boarder at the house of one Mrs. Wilcox. There had previously been a gas service in the house, but the connection had been removed by the company. The theft of gas was accomplished by connecting the two arms of the service pipe at the place where the meter had been attached with a piece of lead pipe, and then turning the stop cock so as to allow the gas to flow into the house. The defendant admitted that he suggested making the device and went to a plumber and bought the lead pipe, but stated that when he got home with it he abandoned his intention, and left the piece of pipe in the cellar. There was no proof of who made the connection. The court held that since the prosecution was for a misdemeanor in which, under the law of Minnesota, there are no accessories, anyone who sustained the relation to the offense, which would, in a case of felony have made him an accessory before the facts would be a principal. Therefore, the defendant was guilty even though it was not established that he made the actual connection or turned on the gas.

In the Woods case the defendant was a dancing master and ran an academy in Chicago where he used gas for heating and lighting. It was proved that during several months immediately after the meter reader had gone his round, the defendant would remove the meter and substitute rubber hose connection, so that gas passed directly from the service pipes to the burners. This rubber hose connection he would allow to remain in use about twenty days, when he would remove it and put the meter back until after the meter reader had again gone by. Later on, he fitted up an elaborate system of pipes, which were concealed in the walls of the building, and which connected the gas burners directly with the service pipe and which were controlled by a stop cock, which, when turned, prevented the gas from flowing through the meters, but caused it to flow directly to the burners. This state of affairs was not discovered by the inspectors of the gas company until after more than a year had elapsed. The defendant was arrested, tried and found guilty of theft in a degree constituting grand larceny, and was sentenced to the penitentiary for an indeterminate period.

Interesting Cases.

The litigation between the Brooklyn Heights Railroad Company and the Brooklyn City Railroad Company regarding expenditures made by the former for the electrification of the road after leasing from the Brooklyn City Railroad has been decided in favor of the Brooklyn Heights Company, by an opinion handed down in the Appellate Court Division of the Supreme Court.

RATE REGULATION UNDER CITY FRANCHISE.—A sweeping decision of the United States Supreme Court in the case of the city of Louisville against the Cumberland Telephone & Telegraph Company, which has been pending since 1909, is of general interest to public-service corporations because of the establishment of the principle that the municipality has the right to regulate the rates of a public-service corporation, even though it is not given this privilege in the franchise of the corporation. The telephone company affected had held, in fighting the case, that since its charter did not specifically provide that its rates were subject to regulation by the city, the latter had no such authority. It also fought the rate ordinance on the ground that the schedule of charges provided would not enable it to earn a fair return on its investment. The company won its case in the lower courts, but the Supreme Court holds in the first place that the city can regulate its rates, and in the second that the rates provided are worthy of trial, since the probabilities favor earning at least 8 per cent.

The Electrical Installation at the New Western Pennsylvania Hospital.

There are many towns of several thousand inhabitants that have not as complete an equipment for supplying electric light and power, heat and ice, as has the new Western Pennsylvania Hospital, located between Millvale and Friendship Avenues and Mathilda Street, in the East End of Pittsburgh.

It is rather surprising to one who does not know much about such things, to learn what an important agency electricity is in the hospital's operation. Not only does electricity light the entire institution, but it, through motors, drives the fans that ventilate and heat the building and the pumps that circulate the water which purifies the ventilating air. An electric motor drives the pump that helps make the ice. Electric motors run the elevators. There are electrically heated sterilizers and electric signaling, telephone and clock systems galore. In the laundry, machines are driven by motors and heated by electricity.

The boilers, engines, electric generators and the absorption refrigerating apparatus that cools brine for circulation throughout the hospital buildings, are all housed in the isolated building, shown in Fig. 1. The second story of this building is used for a laundry and the third floor is set apart for attendants' quarters.

The power house is connected with the main hospital building by a tunnel, through which are carried the steam mains for heating, cooking, sterilizing and disinfecting; the general water mains; the mains for cooled water for drinking purposes; the hot water and return circulating pipes; the fire lines, and the vacuum cleaning mains. On the ceiling of the tunnel are supported the electric feeders which connect the main switchboard, located in the engine room, with the distributing switchboard located in the basement of the main hospital building.

The tunnel is large enough not only to provide a runway for the pipes and electric feeders, but to also serve as an inclosed walk from one building to the other. The tunnel roof is flat and is waterproofed for its entire length. The floor is of smooth concrete.

The lighting feeders and mains are three-wire, 115-230-volt, and the power feeders are two-wire, 230-volt. Incandescent lamps operate at 115 volts, and motors at 230 volts. Three Westinghouse 115-230-volt, three-wire generators, driven by Ridgway (Ridgway Dynamo & Engine Company, Ridgway, Pa.) engines, constitute the generating equipment. Two generators have a capacity of 100 kilowatts, and run at 295 revolutions per minute, while the third generator has a capacity of 150 kilowatts and runs at 200 revolutions per minute. There is also installed in the engine room a small storage battery with a motor-generator set for the operation of bells, annunciators and semaphores throughout the hospital.

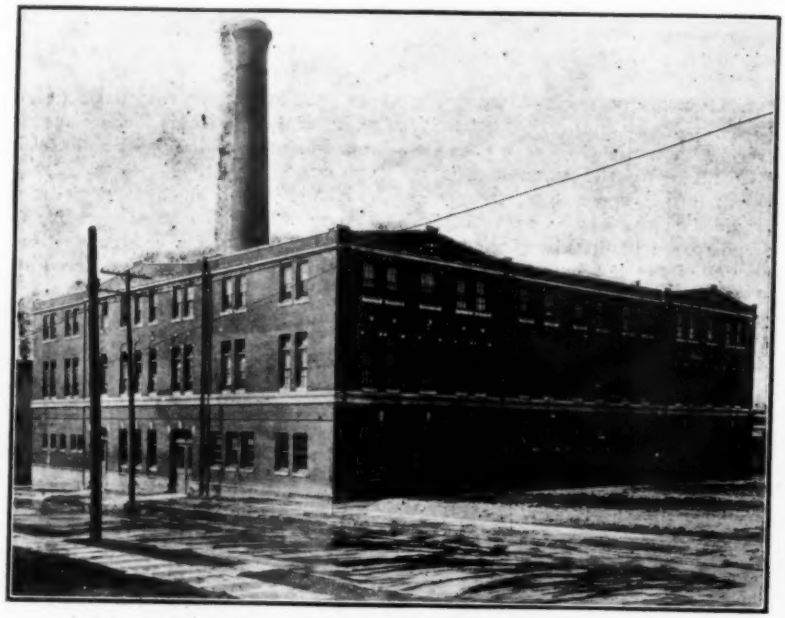


Fig. 1.—Power Plant of Western Pennsylvania Hospital.

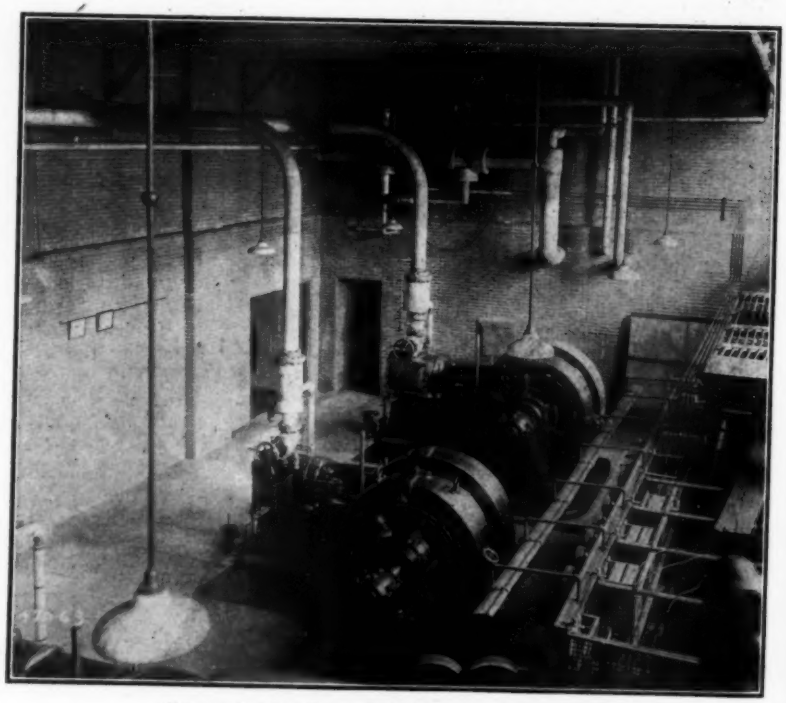


Fig. 2.—Engine-Room Switchboard and Generators.

The white marble switchboard has seven panels; one is for the motor-generator, storage-battery outfit, three are generator panels and three are feeder panels. Suitable meters mounted on the switchboard measure the generator outputs separately.

In the basement of the main building is located a distributing switchboard from which radiates feeders to the panel boards located on the different floors of the building. From these panel boards branch circuits are run to the motor and lighting fixture outlets. All of the fixtures in the building are of the smooth surface type used for hospitals and are very plain.

Tungsten lamps are used throughout the buildings for illumination, and their light is directed by suitable opal-glass shades, which provide the soft light so essential for a hospital. In some of the operating rooms there have been installed specially designed lighting outfits manufactured by the Carl Zeiss Works, of Jena. The design is quite new in this country, but has been used abroad to a considerable extent, and has proven very satisfactory. The device consists essentially of a stereopticon outfit, located in an adjoining room. The beam of light, after being filtered through water, is projected into the operating room and is deflected by a series of reflectors directly to the operating table.

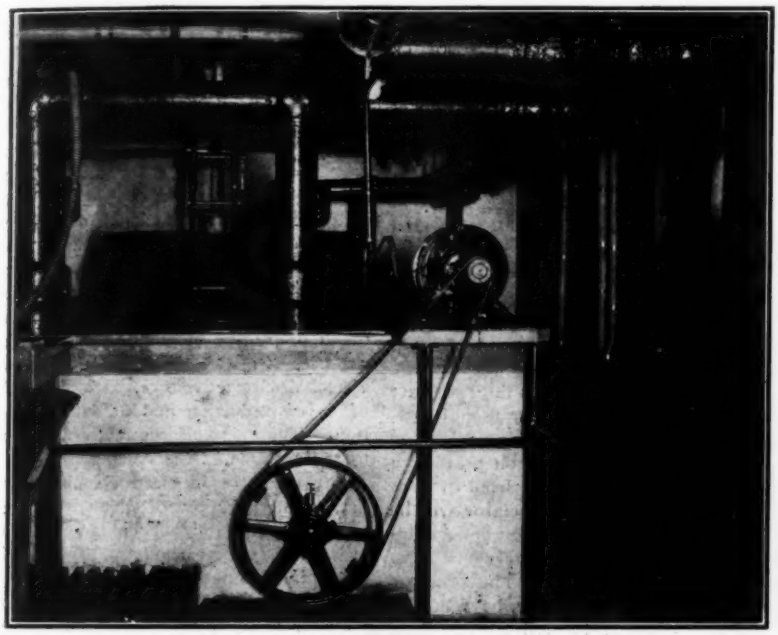


Fig. 3.—Ice-Making Plant in Basement.

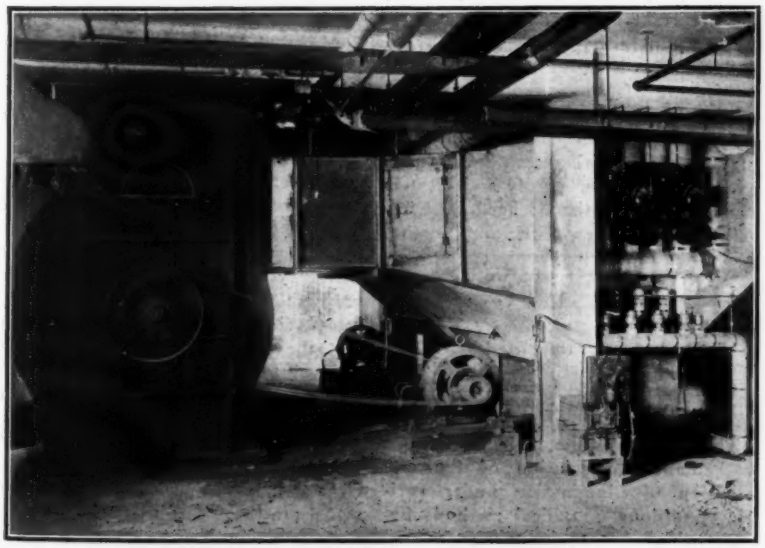


Fig. 4.—Thirteen-Horsepower Motors Driving Ventilating Fans in Basement.

In the basement of the main building is an ice plant (Fig. 3), having a capacity of three tons in 24 hours. The ice is made by circulating brine, which is cooled in the refrigeration plant in the power house, around galvanized-iron cans containing distilled water submerged in the brine. The agitator that circulates the brine is driven by a two-horsepower 230-volt motor, running at 350 revolutions per minute. This block ice is used for various purposes in the hospital.

In the power house is a 35-ton Carbondale absorption refrigerating machine operated by exhaust steam taken from the circulating pumps and machinery. This refrigerating machine cools the brine. It is then circulated by a duplex brine pump through the mains in the tunnel, to risers located in the various sections of the hospital. There are connections to all the diet-kitchen refrigerators located on the various floors, to the cooling morgue, the general refrigerators and to above mentioned freezing tank. The return brine flows back to the pump in the power house. This refrigerating machine also cools the drinking water which circulates through the pipe lines to the various fountains in the building. There is a return back to cooling tank. Thus the water is constantly kept in motion so that drinking water drawn from the faucets is always cool. Since this refrigeration machine is operated by exhaust steam from the circulating pump, the cost of the refrigeration and ice is merely nominal.

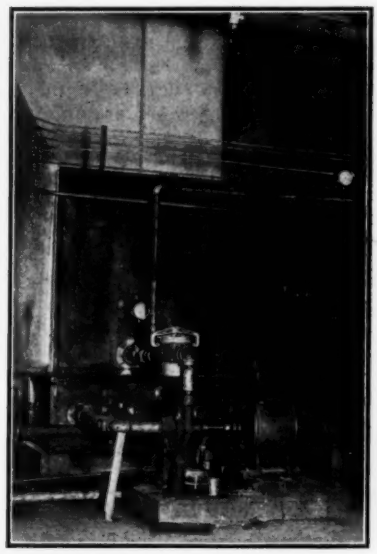


Fig. 5.—Motor Driving Circulating Pump for Air Washer in Attic.

A very elaborate heating and ventilating system has been installed in the hospital. The heating is, in general, effected by forced circulation of warmer air which is supplemented by direct radiation in the corridors and in certain rooms. The fresh air is drawn in from the outside at two points in the basement on opposite sides of the building, and is handled by two separate systems of distribution. The air for each passes through a Carrier air washer and humidifier, which removes all suspended solid matter, dust, soot, etc., and in addition moistens the air by automatically controlled, steam-heated water sprays, which impart to it any desired degree of humidity. The air for each of the systems is then drawn through a pair of American

Blower Company's steel-plate fans (Fig. 4). Each fan has a capacity of 16,000 cubic feet per minute. The air is then reheated by automatically controlled steam heaters and is distributed through the buildings by a double-duct system. The upper duct carries the heated air and the lower duct the tempered air, the mixture of the two being effected by automatically controlled mixing dampers in the bases of the rising flues to the rooms. Each room has one or more temperature-controlling thermostats located in it.

Each of the four above mentioned supply fans is driven by a 13-horsepower, 220-volt, 875-revolutions-per-minute motor as shown in Fig. 4. The speeds of the motors driving these fans can be varied by adjusting the regulating rheostats shown in the illustrations, which, by varying the motor speeds, control the amount of air drawn into the building by the fans. A centrifugal pump re-circulates the water for each of the two air-washer equipments. Each pump is driven by a direct-connected, five-horsepower, 220-volt, 1700-revolutions-per-minute motor.

The exhaust ventilating fans are located in the attic and serve two systems. One is for the general exhaust and the other is for the toilet rooms. The general exhaust is handled by two steel-plate blowers having a total capacity of 66,000 cubic feet of air per minute. These are driven by a 25-horsepower, 220-volt, 760-revolutions-per-minute motor. A regulating rheostat is provided, whereby the speed of this motor, and consequently the amount of air discharged by the fans, can be varied.

The toilet exhaust is handled by a steel-plate blower, having a capacity of 9,000 cubic feet of air per minute, and is driven by a direct-connected, four-horsepower, 220-volt, 375-revolutions-per-minute motor, which is provided with speed-controlling rheostat.

The main operating rooms, located on the sixth floor of the building, have an independent system of air supply and exhaust, the apparatus for which is also in the attic. The air for these is washed by a Carrier washer and humidifier, similar to those installed in the basement. The water for these washers is re-circulated through a centrifugal pump, direct-driven by a two-horsepower, 220-volt, 1200-revolutions-per-minute motor. Air is discharged to the various outlets in the rooms through a steel-plate fan, which has a capacity of 6,000 cubic feet of air per minute, and which may be driven by either of two five-horsepower, 200-volt, 1800-revolutions-per-minute motors.

The exhaust from the fifth and sixth floors is handled through a steel-plate blower, which has a capacity of 5,600 cubic feet of air per minute, and which is driven by a direct-connected, 2.5-horsepower, 220-volt, 450-revolutions-per-minute motor.

The exhaust ventilation from the kitchen, which is located on the fifth floor, is handled through a small exhaust fan directly driven by a one-horsepower, 220-volt, 1000-revolutions-per-minute motor.

There is a separate system of supply and exhaust ventilation for the laundry, which is located in the power house. The supply and exhaust are handled by two steel-plate fans, having a capacity of 4,000 cubic feet of air per minute. Each fan is direct-driven by a 2.25-horsepower, 220-volt, 600-revolutions-per-minute motor.

In the main office is installed an electric master clock of the Magneta type, which operates the clocks located in the corridors of the buildings. Throughout the building are provided wall receptacles for telephone connections to which portable telephones can be attached. Permanent telephones are located at certain places.

Throughout the wards and private rooms is installed a nurses-call system. There is an annunciator located in the duty room, and upon pushing a call button, located at the head of each bed, a drop on the annunciator will be operated and also the semaphore located over the door of the room from which the call is made. The drop on the annunciator can only be reset by the reset-button, located at the head of the bed. The semaphores are of the Holtzer-Cabot Company's make, and are reset by chain pull.

The generating and switchboard equipment and all of the motors described are of Westinghouse make.

John L. Beatty, of Pittsburgh, was the architect for the structure, and the engineer for heating and ventilating, refrigeration, water supply and electric installations was the Richard D. Kimball Company, New York and Boston.

BOOK REVIEWS.

"Principes de la Technique de l'Eclairage." By L. Bloch; translated by G. Roy. Paris: Librairie Gauthier-Villars. Paper, 183 pages (6½ x 10 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This volume is devoted largely to a mathematical calculation of the distribution of illumination under various conditions, graphical methods being avoided. One chapter is devoted to measurements, and consists largely in examples of measurements made by the author, little space being given to descriptions of instruments or their proper use. A short chapter deals with indirect lighting. Descriptions of lighting sources are purposely omitted from the book, and the more recent development in the art of illumination receive no attention. The work will appeal more to those interested in the computation of illumination than to practical workers in the field. The lack of an index, so customary in French publications, is noticeable.

"Laboratory Exercises in Physical Chemistry." By J. N. Pring. Manchester: Sherratt & Hughes. American agents: Longmans, Green & Company, New York. Cloth, 162 pages (5x7¼ inches). Supplied by the Electrical Review Publishing Company for $1.25.

This is a laboratory manual for students. It is divided into three parts, namely: (1) physico-chemical measurements, including molecular-weight determinations, calorimetry, electrochemistry; (2) electrolytic preparations, which comprise directions for making aniline, azobenzene, iodoform, sodium hypochlorite and potassium chlorate; (3) pyrometry, including thermo-electric, radiation, and optical methods of temperature measurement. An appendix contains a table of melting points and boiling points, and tables of specific heats and electrical resistances of metals, electrochemical equivalents, discharge voltage, and potentials of a few reduction and oxidation reactions. The index affords ready reference to the contents of the volume.

The exercises in electrochemistry are limited to calibrations of slide-wire bridge and ammeter, study of charge and discharge of an accumulator, electrolytic depositions and separations of a few common metals, electrolytic estimation of nitrates, measurements of conductances of electrolytes, of single potential differences of various combinations, of electromotive force of gas cells, and of decomposition voltages and oxidation and reduction potentials.

The book is not a complete laboratory manual of exercises in physical chemistry, as its title might imply. It contains a few selected exercises intended for the use of certain students in chemistry who, having had a basal course in physics, need some special physico-chemical laboratory work. Students who pursue chemistry in the better class of American universities now take a complete course in physico-chemical measurements, so that the present volume, while possibly adapted to the particular needs of the English students for whom it is intended, will hardly be adopted in this country.

So far as the description of the individual experiments is concerned, it is clear and shows that it has grown out of actual practice. The brief theoretical explanations given are rather inadequate, though the author states in the preface that these are to be supplemented by reference to other books. The 27 cuts in the book, while perhaps serving to illustrate the experiments, are very crude indeed and not in keeping with the otherwise neat appearance of the volume.

LOUIS KAHLENBERG.

Underground Installations for Steam and Hot-Water Pipes.

At the final session of the National District Heating Association, held in Detroit, Mich., on the afternoon of June 27, there was a discussion of the prevailing methods for the underground installation of steam and hot-water pipes, by representatives of the various companies engaged in this work. Invitations had been sent by Secretary Gaskil to all of the manufacturers in the country whom he could reach, and there were on hand representatives of the H. W. Johns-Manville Company, Michigan Pipe Company, American District Steam Company, Richard-Wilson Company, W. H. Schott Company, and Central Station Engineering Company.

The system of the H. W. Johns-Manville Company was first described by Mr. Stratton, who claimed that the J-M Sectional Conduit gave a maximum protection to the pipe in providing for its durability and the maximum efficiency in transmission of heat.

The J-M sectional tile conduit is water and acid-proof, durable and practically indestructible, giving perfect protection to the pipes, has the maximum efficiency as an insulation and remains so indefinitely, and costs little for maintenance. It is made from a most carefully selected mixture of clays, designed to perfectly withstand the heat necessary for vitrification, which very greatly exceeds any possible heat obtainable from steam-heated surfaces. The clays are carefully selected, ground and mixed under the direction of experts, the molds are specially made for the purpose of making this conduit, and the most modern methods and extreme care are used in drying the conduit. The entire conduit is thoroughly salt-glazed inside and out. The vitrifying and glazing are so thoroughly done that moisture cannot pass through, even though the material still retains its innumerable air cells, making in itself a good insulator. The conduit is made in three-foot lengths. After coming from the press, the conduit is cut partially through so that after coming from the kiln it may be separated, provision being made from the re-mating of the conduit's halves at the time of installation, by numbering the top and bottom parts to match. The separation leaves rough cerated edges for more than half the thickness of the conduit, which makes possible a perfect joint by the use of Portland cement when applying the top half to the bottom half.

The plain sections form the greater part of the insulation, the conduits used being interrupted only by supporting tees set fifteen or eighteen feet on centers, depending on the size of pipe to be protected. The supporting tee provides for the use of roll frames with rolls, making a combination provided for the support of the pipes, entirely independent of the conduit itself and permitting freedom of expansion and contraction of pipes.

The base of the supporting tee is filled with concrete, into which the roll frame sets and is firmly held, the body of concrete being sufficient to carry the weight and movement of the pipes, independent of the conduit itself. The roll frames are made for any number of pipes from one to six, thus permitting this number of pipes to be installed in a single conduit, reducing cost of installation and loss of heat. A union is used but once in each run of conduit, the intention being to reverse the bell on the conduit at one end, so that the bell ends may be available at the wall of the building on each end, for the proper introduction of shutters. The size of the conduit is so determined that there shall be a space of three inches between the pipe and the conduit, which space is filled with insulating material.

Extensive tests have demonstrated that asbestos may be so made as to constitute the best known pipe covering, even exceeding magnesia in efficiency. Asbestos, in combination with fine particles of sponge, is used for insulating material, the entire space about the pipes and between the pipe and conduits being filled with this material, the minimum thickness being three inches.

At each end of each run of conduit a shutter made of cement is provided to retain the insulating material and to prevent passage of vermin from one building to another, the passages being provided with sleeves before the application of this shutter.

The innumerable finely divided air cells within the insulating material is an important feature in the efficiency of this insulating material. The absolute prevention of the movement of air over the pipes or the insulation is an important factor in the results obtained. An underdrain under the entire length of the conduit is regarded as a most necessary and valuable adjustment, in that it keeps the water from about the conduit, thus lessening the absorption of heat therefrom, the size of the underdrain being determined according to the amount of water probably to be found in the ground and the length of the underground lines.

This form of conduit has special advantages in long lines of steam transmission, in that 400 and even 500 feet of pipe may be laid before necessitating the use of expansion jomts, expansion arms or manholes and experience has shown that it is most desirable to eliminate all expansion, expansion arms or manholes, and experience has sible to do so. The cost of construction and the difficulty of waterproofing are alone sufficient arguments against their use any further than is absolutely essential. Where required for building connections, valves, etc., they are used in this system of conduit construction and double, watertight manhole covers are provided for all manholes.

There are already in use over thirty-five miles of this material and the amount now being installed approximates nearly ten miles each year.

Efficient tests have been made from time to time, one of the earliest being made by George H. Harris, which showed an efficiency of 88.7 per cent as compared with a loss from bare pipes in 70 degrees, still air.

A test made by the R. M. Hunt Company on a later and better installed system, showed an insulating efficiency of 94 per cent on the same basis of comparison. Other tests showed efficiences varying from 90 per cent to 94 per cent, demonstrating the wonderful efficiency of this conduit system as an insulator. The usual maximum efficiency secured in the best makes of pipe covering are 88 per cent and the best result of which we have been able to learn in the case of the wood conduits is 72 per cent, the loss in pipe covering with best grade of asbestos and magnesia pipe, being twice that found in the sectional conduit, while the loss in the wood conduits is found to be more than four times that in sectional conduits.

This material has been used under every possible condition and found to fulfill all the requirements essential to a perfect underground system of conduits. It may be laid and later opened or re-located at will, in the case of leaks. The installation of steam pipes in this conduit involves an expense but half that required in the case of a large tunnel, and insures a greater efficiency, while the expense as compared with wood conduits is greater and a much greater efficiency is assured.

The work of the Michigan Pipe Company was then described by Mr. Smith.

Forty years ago the Michigan Pipe Company put on the market a tin-lined wood covering for underground steam pipes, which was found to be nearly a perfect insulator. We have improved upon this casing with reference to its ability to withstand all attack from the outside until we have a simple and durable material which reduces heat loss by condensation and radiation to a minimum.

"Michigan" steam-pipe casings are used for insulating underground steam pipes for either exhaust or live-steam heating systems. In manufacturing our casings we have brought together materials which are most effectual in warding off the natural enemies of steam pipes of this nature.

"Michigan" casings are manufactured of thoroughly seasoned Michigan white pine and tamarack of the solid log in the smaller sizes and in the built-up form in the large sizes. The casings are made in lengths up to eight feet and strengthened with a No. 6 double-galvanized steel wire. The outer and inner surfaces of the casing conform exactly to the size of the pipe desired. The sides of the staves used in the manufacture of the built-up pipe are furnished with tongue and groove running the entire length. The interior of the casing is lined with bright tin. The outer surface is coated with a heavy waterproof asphaltum coating, which is unaffected by a high temperature, and the pipe is rolled in a fine sawdust while the coating is still hot, this sawdust covering acting as a protection against rough usage on route. Also the mortise-and-tenon ends of the casing are treated with a special creosote preparation.

The wood is a nonconductor of heat and cold. The tin lining has reflecting powers in concentrating the heat rays at the wrought-iron pipe. Moreover, we allow for a dead air space of from 2 to 3 inches and a half inch between the wrought pipe and the covering. This space also allows for the placing of pipe guides or rests in the line. These guides take care of all expansion, and also bring the steam pipe equidistant from the inside of the casing. The outer coating of asphalt pro-

tects the outer surface of the pipe absolutely from the effects of dampness or drainage. The joint is so formed that it is absolutely waterproof. The construction of the casings is simple. The materials themselves are extremely durable, having been known to last for 30 years, and the method of installation requires no skilled labor, as the sections are merely driven together forming a driving fit, the mortise-and-tenon joints fitting snugly together. Also, our materials will stand heavy usage without deteriorating in the least. "Michigan" casings are made from timber lumbered and manufactured by ourselves. In this way, the decreased expense allows us to select only the best of the cut for the purpose. Each stave which goes to make up our casings is inspected several times before it is finally assembled. The casings are subjected to a final inspection before shipment is made.

The tamarack wood of which most of our materials are manufactured is one of the hardiest of woods. The grain of this wood is very coarse, and yet very close. The wood contains very little sap and has the appearance of hardwood when finished. Tamarack is considered one of the most durable of woods and is used extensively for telephone poles, ties, etc., in places where an ordinary wood will rot out in a comparatively short time.

The methods of the American District Heating Company were next described by Mr. Austin.

For the manufacture of the various devices used in the underground construction only the highest grades of raw materials are purchased, under the strictest specifications, and these materials upon delivery are subjected to the most rigid tests before acceptance. On underground installation work, and in the manufacture of the raw materials at the shops, only the highest and most improved type and grade of machine and hand tools are used. The workmen connected with the manufacturing end of our business and those employed to take charge of our construction work are experienced men trained in that particular line of business.

The various materials which are incorporated in the many different designs of underground heating systems may be grouped under four principal heads, as follows: underdrainage, pipe, pipe fittings and insulation.

One of the most important elements of any underground heating system is the underdrainage, and the careful choice of kind of tile and porous filler to be used around same, together with the proper method of laying tile and placing the porous filler, is most necessary.

After grading the main trench to the grade pegs which are set every ten feet in trench bottom by the engineer, subtrenches 8 inches wide and 14 inches deep are cut in the bottom of the trench at each side. In each of these trenches is laid a line of hard-burned farm-drain tile with butt joints. Over each joint is placed a strip of paper 4 inches wide and of a length equal to three-quarters of the outside circumference of the tile. This strip of tar paper laps 2 inches on the end of each tile at joint and covers the top three-quarters of the joint. The tile trench is then filled to grade with clean crushed stone or coarse gravel. At the time the tile trenches are excavated the middle bench of dirt between same is lowered a few inches below grade pegs and at the time the tile trenches are filled with crushed stone or coarse gravel the middle bench is also filled to grade with the same material. Thus the entire trench bottom is covered with porous material which furnishes a bed for the casing to rest on, and at the same time a free waterway for seepage or other water to the drain tile.

The selection of pipe for underground heating mains is limited to three kinds, steel, cast iron and wrought iron. Steel pipe deteriorates very rapidly under the working conditions of a heating system, and it is therefore not adapted to the purpose. Cast-iron pipe necessitates the use of a large percentage of additional flanges and an additional expense of construction and is, therefore, not suited to the work. Strictly full-weight wrought-iron line pipe seems to fill all requirements of the heating business in the most satisfactory manner, and this with long recessed couplings is used in all underground construction work for both mains and services.

The various pipe fittings used in underground heating systems have in general three duties to perform, namely, anchor the line at fixed points, take care of expansion of pipe and afford service openings. Pipe fittings which combine certain of these duties are used as follows.

At intervals of about 100 feet in the heating main a packingless expansion device called a "double variator" is installed. Midway between these double variators is installed an anchor fitting called an "anchor special." Thus there is about 50 feet of pipe expanding into each side or slip of the double variator from the anchor specials. In a continuous run of pipe there is a double variator about every 100 feet, and an anchor special about every 100 feet, alternating in position and making an average of a fitting about every 50 feet, with two service openings. At street intersections, sweep-angle tees or crosses with valves bolted to them replace the anchor specials. A single variator is used whenever the run of main overruns the even divisions of about 100 feet by 50 feet or less. The single variator has one anchored side and one slip side which will take care of the expansion up to 50 feet. It is especially adapted for use where the pipe line has to follow the curve of a street. The double variator has an anchored middle ring; the single variator has one side anchored; and the anchor special, crosses and tees are as a whole solidly anchored. The double variator, single variator and anchor specials have service openings on both sides at the top, which take steam from the top of the steam main and thus prevent main-line condensation from entering services. These variators also act as separators and free the steam of water of entrainment before the steam enters the services from them.

The double and single variators are of the packingless type; in other words they do not need repacking from time to time, the same as the old-fashioned or ordinary type of slip joint which has packing glands and rings of packing to prevent escape of steam and water. This packingless feature is accomplished by the use of corrugated copper diaphragms fastened to the center ring, and to the slip of the device. The packingless feature does away with the expense of manhole and cover as called for in types of slip joints requiring packing. Manholes not only deface the pavements, which is very objectionable to municipalities, but manholes are also the source of loss of heat by conduction and radiation.

The street-corner special fittings such as crosses, tees, ells, etc., are of the sweep-angle type and are designed to reduce the friction to a minimum. All reducing special fittings are made either concentric or eccentric to suit conditions. This enables one to direct the flow of line condensation at junction points of the heating system in the desired direction.

For standard insulating material, a round wood-stave casing 4 inches in thickness is used. It is tin-lined, with an inside diameter about 2 inches greater than the outside diameter of the pipe over which it is placed.

This type of insulating casing, in its primitive form, was used when the first underground steam-heating system was installed at Lockport, N. Y., in 1877. Since that time every kind of insulating material, as it appeared on the market, has been tried and tested but up to the present time wood casing has been adhered to as the best and most efficient insulation for steam mains.

This wood casing is now built up from staves of selected white-pine stock, sound and free from sap, and thoroughly air and kiln-dried. These staves have tongue and groove extending their full length, which, when locked by the pressure of the spirally would binding wire, provide great strength to resist crushing strains. After being assembled and banded, the casing is rolled in a hot asphaltum bath, which impregnates the outer surface, and then rolled in sawdust. It is then lined with AAAA charcoal tin plate which not only adds to the casing's insulating qualities, but also prevents charring of the inside surface of the wood casing. The materials of which the casing is made, together with the methods of manufacture and construction, afford absolute protection against electrolysis.

The method of assembling the materials on underground construction work is briefly as follows. A length of iron pipe, with a flange made on one end, is lowered into the trench as prepared, and wound spirally with a double layer of one-thirty-second-inch asbestos paper held in place with No. 19 copper wire wound spirally over same. Over this length of iron pipe is slid a length of wood insulating casing of about 2 inches larger diameter than the iron pipe. A roller guide is then inserted between the inside bottom of the casing and the under side of the iron pipe. This guide centers the iron pipe in the casing, thus making an even air space of about an inch all around the iron pipe, and also allows for the expansion movement of the iron pipe.

Each length of casing has a four-inch mortise on one end and a tenon on the opposite end. The first piece of casing placed on the iron pipe has the tenon sawed off and the flat end surface of the casing is painted with pitch and butted snugly against a cast-iron collar which has its other surface against the hub of the starting flange on the pipe. This collar is made in

two halves which bolt together in place over the iron pipe and close off the air space in the casing, thus forming a dead-air space for insulating purposes, and it also furnishes aid in anchoring the main in brick work at points where anchor devices are installed. The tenon of one piece of casing enters the mortise of another piece and forms a driven joint with same. At time of driving this joint it is poured with an asphaltum filler which is prevented from running out, while hot, by a band of three-ply tar paper eight inches wide which encircles the casing at the joint and laps eight inches on top. This band is cemented by the filler to the casing and the lap is nailed in place on top. This filler has qualities exceptionally adapted to the purpose, as it is pliable at 32 degrees and does not melt below 350 degrees. Thus, it will not crack when line is cold nor will it melt under temperature of steam line. The casing so installed forms a waterproof insulation of lasting qualities and of the highest efficiency.

As soon as the section of pipe reaches a length of about 50 feet a flange is made on and the proper device or pipe fitting for that point is attached. All devices are flanged and the flange joints are all made up with corrugated copper gaskets.

The pipe fittings or devices are incased in brick boxes with nine-inch walls plastered inside and out, every precaution being taken to have the brick work absolutely waterproof. The service nipples project from the fitting through the side walls of the brick box and are wrapped with asbestos paper held in place with copper wire, similar to main-line pipe, and covered by waterproof nipple boxes which tie into brick walls.

After the main has been tested the space around the fittings in the brick boxes is packed with dry soft-wood shavings, free from tannic acid, and covers are then placed on the brick boxes. These covers are made up of hard-wood plank, three-ply ear and brick work well plastered, and form waterproof covers for the brick boxes incasing the devices.

The heating is relieved of line condensation at low points by means of automatic traps. Each trap is in an independent manhole, together with a meter which receives the condensation from the trap and records the amount of condensation by weight before discharging same into sewer outlet from manhole. At other than low points, when necessary, the line condensation is intercepted by a line separator which empties into a automatic trap.

The system of the Richard-Wilson Company was next described by Mr. Wilson, who said that the object in view in devising the Ric-Wil underground pipe covering was to devise an underground covering which would give the maximum efficiency at a minimum cost and constitute a permanent installation. The product showed an efficiency of 90 per cent in a laboratory test made at the University of Michigan.

Salt-glazed sewer tile is permanent. This is the waterproof casing, but waterproofing is further taken care of by using a base drain. This base drain does not only take care of the drainage but by its construction it gives an added rigidity to the tile proper. The material which is used for insulation is a diatomaceous earth. This material as an insulating product has been known for years to contain all the high-grade properties of insulating material, but only recently have means of combining it with other materials to use as pipe covering been found. The present formula gives a result such that it is absolutely impossible to affect it by moisture. If for any unforeseen reason or accident this material should become wet, the only damage is that it loses its insulating efficiency while it is wet. As soon as the material becomes dry it is in perfect condition.

Ease of installation is another point. The base drain is first laid in the trench; on this the lower half of the tile, the spigot end being placed in the bell end and cemented by an elastic cement making a watertight as well as an airtight proposition. Every eight feet is then put in the roller bearing for carrying the pipe, the pipe not coming in contact with the insulation at any point. This gives freedom in the expansion of the pipe which no other covering does.

Another advantage in the installation is that the pipe can be coupled from manhole to manhole and test made before covering and after the joints are tight the lid of the pipe is put on and back filling completed. One can always tell whether the drain is free, since the opening of the drain is on a level with the floor of the manholes. If the distance between manholes is too great to see a light from one manhole to the other through the drain it is an easy matter to put a hose in the base and flush it out.

The Schott system of underground construction was next described by Mr. Payne. He stated that the Schott company has been engaged in the construction of underground heating mains for 12 years past, starting with the old type of box construction known as the Yaryan system.

In improving upon this, the successive steps were the use of a wool felt which was found to deteriorate rapidly, a square form of concrete conduit, using various types of pump log, the Michigan Pipe Company's covering, and the Wyckoff. Many types of installation are highly efficient when first installed, but soon deteriorate. To obviate this a glazed tile known as the Book tile form of construction in connection with asbestos and wool-felt insulation was next used. This was fastened on by copper wire or brass bands. As the latter would disintegrate due to the moisture, another advance was made in the molding of a reinforced-concrete conduit made of waterproof cement. By means of this, asbestos insulation was suspended around the heating main with an air space in between, the circulation in the air space being prevented by fittings at intervals along the pipe. The insulation is pure asbestos, two inches thick, filled with innumerable layers of air cells, and suspended in position by 1.5 inches of reinforced waterproof concrete conduit. Joints in the insulation are broken both lengthwise and circumferentially. The strength of the waterproof joint is shown by the fact that conduit which has been disinterred and broken into will often break crosswise at the joints.

The trench is first prepared and filled with approximately 4 to 6 inches of crushed rock in which the 4-inch underdrain is laid, thus giving a solid foundation for the support of the heating main. Blocks are laid approximately 4 inches in height on this crushed rock, and the pipe line laid and made up. The tile, the bottom half of the concrete conduit is then put in position and the bottom joints made, the roller bearings put in place and the pipe thoroughly alined. After that the outside layer, an inch in thickness, is put in place, then the inside layer, also an inch in thickness, put in place, and the top half of the conduit brought down and a joint made. Thus it suspends around the heating main the asbestos insulation, so that the heating main proper lies in the conduit and travels absolutely freely and independently, not having any bearing whatever upon the insulation or the conduit surrounding it.

A maximum efficiency is secured with a minimum cost. In the making up of this conduit no shipments of the complete conduit to any point are made. Material is bought on the ground. This eliminates any breakage in the handling of the conduit. It allows also of frequent changes, in case such conditions arise, and changes are desired very frequently as the installation proceeds. This allows making up in any form or any size of conduit.

As to the efficiency of this insulation, no experts have tested it, but it will deliver 95 per cent of the steam to the consumer that is put into the heating main at the power house.

The practice of the Central Station Engineering Company was then described by Mr. Gillam.

This company uses a hollow-tile conduit to act as a mechanical protection to the insulation. The insulation is designed according to the requirements of each particular case, a standard covering not being considered suitable for all conditions, such as a low-temperature steam or water plant, and a high-pressure or superheated steam system. The trench is graded to give proper drainage, as this is one of the most important features in a correct system. The others are the perfect insulation of the pipe, making it waterproof, and the careful protection of this insulation. The underdrain is laid in fine crushed stone or gravel on an accurate grade, and drains to the manholes. Or, if there is a sandy soil and it is not convenient to reach the sewers, the drain is sumped into the sand. A three to five-inch concrete base is laid on top of the drain-tile and care is taken in grading this base to the manholes. Then if there is any leakage through the conduit on to the waterproof covering, it rolls off the latter to the base and in that way to the manholes. The insulation is thus kept perfectly dry. After the base is graded perfectly, the roller guides and roller plates are set in the pipe, placed in position and screwed up, tests are made and the coverings applied. The insulation consists of one-inch asbestos next to the steam pipe. This is made up of alternate layers of indented asbestos in order to get the greatest amount of confined air space. In this way there are 27 layers to the inch. On a low-pressure, line, two inches of covering are recom-

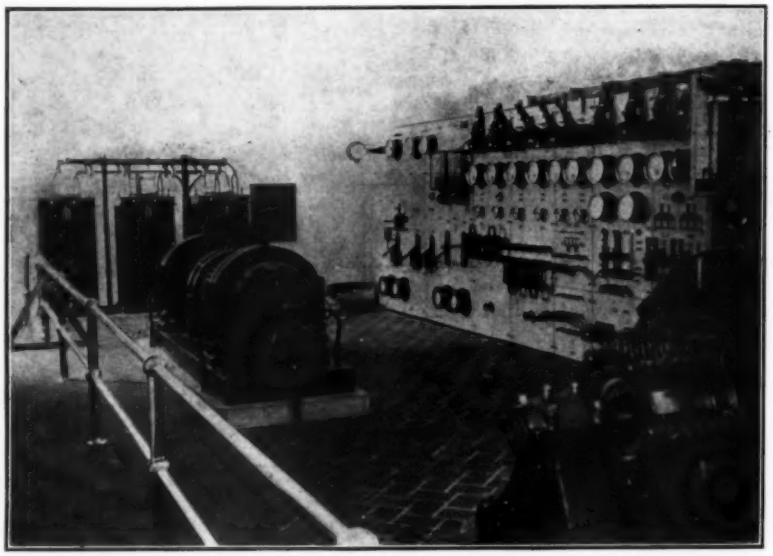
mended. The second inch would consist of alternate layers of asbestos and wool felt, or sponge covering. This insulation comes in sections with a canvas lay on the top. When the second layer is put on, the joints are staggered both longitudinally and circumferentially. Finally a heavy coat of asphaltum is added to make it waterproof. After the covering is placed on and cemented a conduit is built up of hollow glazed tile which has been burned at 2,500 degrees Fahrenheit. This not only acts as a physical protection to the insulation material, but also gives additional insulation to the system, by reason of having a sealed air space in the tile. The tile is about four inches thick. At the manholes a collar is used to seal them and to prevent air circulation through the pipes. Where this is not used soft wood shavings are packed over the pipe to prevent air circulation. The crushed stone or gravel is carried to the top of the conduit construction in order to provide for free under-drainage and prevent pressure on the joints. The tile is laid in waterproofing.

Synthetic Rubber.

It is well known that the increasng demand for rubber during recent years, and possibly financial operations at times have caused the price of this commodity to be unduly high, so with a view to putting a stop to this state of things rubber substitutes of various kinds have been placed on the market. Some of these have obtained a certain measure of success, but have had little effect on the price of the natural product. True artificial rubber, for which we have long waited, has not been among these substitutes. A further and much more important step forward, has, however, now been announced. It appears that it is now possible to build up rubber synthetically from starch according to a fermentation method devised by Professor Fernbach, of Pasteur Institute. This process, it is stated, also allows fusel oil and acetone to be produced and sold at prices far lower than is at present the case. The first step in the process is in fact the production of fusel oil and acetone from starch-containing substances by fermentation. The next operation consists in subjecting isoamyl alcohol, which is obtained by distillation from the fermentation products, to the action of hydrochloric acid, while in the third the vapor is the isoamyl monochloride thus obtained is treated with chlorine gas, resulting in the production of isoamyl dichloride. This latter substance is then passed over lime heated in an iron tube and the isoprene so formed is polymerised into rubber by contact with metallic sodium, the change being assisted by heat and taking place in a few hours, weeks or days, according to the temperature employed. In this way it is possible to build up by a true synthetic process a rubber closely resembling the latex that comes from the tree.—*Electrician.*

Power Plant for the Harriman Estate.

There has recently been put in service on the estate of Mrs. E. H. Harriman, Arden, N. Y., an extensive power generating and distributing system which presents several features of interest. On account of the situation of the generating station it was essential that there should be as little noise from it as possible and that unsightly features, such as stacks, smoke and exhaust steam, be eliminated. A producer-gas engine-driven generating station was, therefore, determined upon. The service required of this station was somewhat unusual and severe, involving three separate functions: first, the supply of power for hoists and blowers at the mine of the Sterling Iron & Railway Company, 12 miles distant; second, the supply of current for lighting various houses in the vicinity of the power station, and, third, the supply of current to the Harriman mansion for a great variety of purposes, including lighting, electric elevators, electric heating and the operation of an inclined cable road about 3,100 feet in length.



Harriman Substation.

The power house at Harriman is a stone and concrete building located adjacent to the main-line tracks of the Erie Railroad. The building is L-shaped, the main portion being 180 by 55 feet, containing the engine room, transformer room and offices. The other portion is 100 by 46 feet, and contains the producer room and coal pockets. A siding from the railroad tracks runs directly above the coal pockets so that the coal can be dumped from the cars without handling. The coal is drawn out from the pockets into small hopper cars and raised by an elevator to the charging platform at the top of the producers.

The producer house is laid out for five 350-horsepower Westinghouse bituminous suction producers, only three of which are at present installed. Each producer has sufficient capacity to supply one of the main engines, and is provided with a wet and dry scrubber. There are three motor-driven Root exhausters for maintaining the pressure in the gas main; one exhauster also has a pulley so that it can be belted to a 15-horsepower gasoline engine for use in starting the plant. There are two motor-driven single-stage turbine centrifugal water-circulating pumps having a capacity of 250 gallons per minute. One of these pumps can also be belted to a gasoline engine for emergency service. These pumps furnish cooling water for the producers and engines. There is one motor-driven, double-acting, single-stage air compressor which will deliver air at 200 pounds pressure and one similar compressor arranged to be belted from a gasoline engine for use in starting or emergency. The compressors pump air into three steel receiving tanks, one of which is ample for ordinary starting operations, leaving one in reserve.

The engine room is laid out for five gas engines, but only three are at present installed. These engines are 18-by-26-inch tandem, horizontal, double-acting Westinghouse gas engines, rated at 340 brake horsepower. There are three sources of supply for the ignition system; a storage battery, a small motor-generator set and the exciter generators.

The main generators are direct-connected to the gas engines and are rated at 250 kilowatts, 2,400 volts, three-phase, 60 cycles. There are two 40-kilowatt, 125-volt, shunt-wound excit-

ers, each direct-connected to a three-cylinder vertical, single-acting Westinghouse gas engine.

The switchboard consists of thirteen blue Vermont-marble panels and contains the exciter and generator panels, a Tirrill regulator panel, station auxiliary panel, and four feeder panels.

The 2,400-volt switches and busbars are located in a room in the basement directly below the switchboard so that all 2,400-volt circuits are kept off the main floor. There are three 125-kilowatt, oil-insulated, self-cooling transformers which step-up the voltage from 2,400 to 13,200 for transmission to Sterling Lake.

Electrolytic lightning arresters are provided for the 13,200-volt circuit and arresters are provided for the 2,400-volt feeders. All the switching and transformer equipment was furnished by the Westinghouse Electric & Manufacturing Company.

The feeders leaving the station consist of two 2,400-volt feeders to the house substation; one No. 4 2,400-volt feeder for local supply near the power house, and one 13,200-volt line to Sterling Lake with a space on the poles for a second line. All of the lines run overhead with the exception of the house feeders, which are placed in conduit from the foot of the mountain up to the substation, a distance of about 3,500 feet.

The house substation is used entirely for supplying light and power to the mansion and the surrounding buildings and is located about 1,000 feet from the house. Besides the lights in the house and on the grounds there are a number of small motors for pumps, refrigeration, etc., an electric hoist for operating the incline railway running from the foot of the mountain and an 88-kilowatt water heater for heating the green house located near the house.

The substation building is L-shaped, the main portion containing a garage with a hoist room below, a generator and switchboard room 50 by 27 feet, while the other section of the building contains a battery room 23 by 54 feet. The generator room contains two motor-generator sets, each consisting of two 70-kilowatt, 125-volt, direct-current generators, direct-connected to a 2,300-volt induction motor. The two generators are connected in series for operation on a three-wire system. There is also a booster set for charging the battery and three transformers supplying power to the incline hoist and the motor of the booster set. In the battery room there is a 1,600-ampere-hour storage battery, arranged for three-wire operation, with two motor-operated end-cell switches located in the generator room. The switchboard is of blue Vermont marble and comprises transformer, generator and feeder panels.

All feeders leaving the station for supplying the house and grounds are for 240 volts, three-wire, direct current, and are run underground in iron conduit. The generators in the substation were furnished by the Ridgway Dynamo & Engine Company, the transformers by the American Transformer Company, the switching equipment by the Westinghouse Electric & Manufacturing Company, the storage battery by the Gould Storage Battery Company, and the end-cell switches by the A. & G. M. Anderson Manufacturing Company.

The power house and substation buildings were erected by the Harriman estate. Carrere & Hastings were the architects. Westinghouse, Church, Kerr & Company were engineers for the equipment in both power station and substation and installed this equipment under the supervision of C. T. Ford, the superintendent of the Harriman estate.

A New Radiation Akin to X-Rays.

A new form of dark radiation seems to have been discovered by Prof. A. Remele, who has been experimenting for some years with nitrate of boron. He has found, says the *Scientific American*, that this substance gives off at ordinary temperature radiations which will influence a photographic plate through several thicknesses of black paper, leather, India rubber and glass, and the images obtained strongly resemble those given by X-rays. The radiations are completely absorbed by metals. Electroscopic examination shows that nitrate of boron—like nitrate of uranium—emits electrons, or negative particles, and it is suggested that this points to some connection of nitrogen with radio-active phenomena hitherto unsuspected. It is certainly curious that, up to the present, radio-activity has generally manifested itself in the presence of salts.

Government Award of Contracts.

The following awards of contracts have been announced by the Government: lead-sheathed rubber-insulated cable for the Norfolk Bureau of Yards and Docks, to the Standard Underground Cable Company of Pittsburgh, at $19,125.71; electric spot welding machine for Mare Island Bureau of Construction and Repair, to the Winfield Electric Welding Machine Company, of Washington, D. C., at $682.

According to the last census, Philadelphia has a total number of electric machinery and supply houses amounting to 45, employing 1,759 persons at a cost of $923,000, and turning out $7,065,000 worth of goods annually.

Electric Laundry Irons.

In the course of his annual report on electrical accidents in the United Kingdom, G. S. Ram, the government electrical inspector, has some remarks concerning electric irons. He says that manufacturers of these articles do not yet appear to have realized that when they are used on factory premises they come under the Regulations, and that in many places they are liable to be used under conditions which necessitate their being earthed, no provision being made for the attachment of an earthed wire. In one laundry Mr. Ram found ten irons in use on a 200-volt alternating-current supply. The floor was of brick, noninsulating, and the girls complained that they received shocks from the irons, and had to be very careful to handle them with a cloth so as not to touch the metal parts. The flexible wires which were all twisted up and the insulation damaged, were connected by means of adapters to lampholders and there was no switch in the room, the only switch being the main supply switch in the adjoining passage, placed quite out of reach. The conditions were such as might readily lead to a fatal accident. Mr. Ram reports that the proprietor raised no objection to discontinuing the use of the irons as he had decided to do so in any case within a few days owing to the fact that they did not get hot enough for the work. "While electri supply authorities are using every endeavor to get their consumers to adopt electrical methods of working, it seems a pity that in such cases as this there should not be supervision to insure that the consumer shall get an article suitable to his needs and also that it should be properly and safely installed." The trouble of the flexible wires becoming twisted up into knots and damaged by repeated pulling out is a common one with electric irons. Mr. Ram found in another case that it had been overcome by the use of flexible metallic sheathing. This was rigidly fixed at one end at a point about five feet above the table, and at the other to the iron. While this gave all necessary flexibility for the movement of the iron it was found that the latter could not be twisted round more than a couple of turns without causing such a strain on the girl's wrist as to cause her to untwist it. If twisted up for more than a couple of turns it would of itself untwist turning the iron round when the handle was removed.

By a recent order of the Electrical Bureau of Philadelphia, all electric signs must be hung 12 feet from the ground and may not extend more than four feet, three inches from the building line.

New Electrical and Mechanical Appliances

Sangamo Ampere-Hour Meters for Electric Vehicles.

With the tremendous increase in the use of electric vehicles during the past few years, the question of battery performance and a proper measurement thereof has become of great importance. Until three years ago the measurement of current put into, or taken from, a battery was obtained entirely by ammeter and voltmeter, these instruments having been in general use on electric vehicles prior to that time.

In the early part of 1910 the first Sangamo ampere-hour meter for use on electric vehicles was produced. This meter was developed along the same lines as the well-known Sangamo mercury motor watt-hour meter, which had been on the market for a number of years, and from the time the ampere-hour meter was produced it filled the demand for an instrument which would not merely show the momentary or varying values of current and voltage of a storage battery, but would indicate upon some form of dial the condition of the battery with respect to charge at any time. While it may be desirable to have a voltmeter and ammeter, and particularly the latter, on an electric vehicle, if used by someone properly understanding the meaning and purpose of these instruments when used with storage batteries, yet it is unquestionably much better if an instrument is used which requires no knowledge of electricity, or the peculiar conditions attending the charge and discharge of a storage battery. This requirement is met by the Sangamo ampere-hour meter.

Fig. 1.—Flush-Type Distant-Dial Mechanism.

Previous to the introduction of this meter, the hydrometer was the only instrument which could really be relied upon to give correct information in regard to the condition of a battery. However, the nature of a hydrometer and its construction makes the use of such an instrument in actual service practically almost impossible, and it could not be generally adopted except for use with stationary batteries.

Fig. 2.—Projecting-Type Distant-Dial Mechanism.

Types.—Sangamo ampere-hour meters are now furnished in two general types for electric vehicle service, the self-contained meter, as made for the last three years, and the distant-dial type, as described below. In the self-contained type, the meter is built in three general forms, exactly alike in internal construction, operating characteristics, etc., but differing in the arrangement of the base castings and connections.

Distant-Dial Meters.—The distant-dial ampere-hour meter has been developed to meet the demand for a meter in which the recording dial may be placed at any desired point on a vehicle, more or less remote from the meter proper. The meter corresponds in construction and operation, except for its recording train, to the standard ampere-hour meter referred to above, and it may be placed beneath the seat, if the space allows, or it may be attached by a suitable support directly to the chassis of the vehicle. The dial mechanism, requiring a space about 3.75 inches in diameter, is so designed that it may be placed at any desired point within the body of the vehicle, and in any position, vertical, horizontal or angular. The standard flush type of dial mechanism (Fig. 1) is designed to set back in to the support on which it is mounted, as in the upholstering at the side of a seat in a pleasure vehicle.

The projecting type, which is the same (except for the external casing) as the flush type, is shown in Fig. 2. The dial mechanism can also be furnished in a semi-flush type, with a flange at any desired distance from the front. The depth of the mechanism over all in the flush or projecting types is about two inches. The meter proper, as used with the distant-dial mechanism, is shown with cover off in Fig. 3, and a contact train removed from the meter is shown at one side, from which the construction of this part may be seen.

Fig. 3.—Distant-Dial Ampere-Hour Meter and Contact Train.

Operation of Contact Mechanism in Meter.—The contact train takes the place of the usual recording mechanism and, instead of driving a hand that shows directly on a dial the condition of the battery, it closes a contact at equal intervals of ampere-hours registered by the meter, the closing of such contacts operating one of two electromagnets in the

distant-dial mechanism. The contact mechanism is so designed that it closes circuit to one contact on charge and to the other on discharge of the battery, and so that in case of a failure of the dial mechanism to operate, on account of a break in the connecting wires between the meter and dial, the rotation of the meter proper will not be stopped, as the wheel driving the contact in the contact train will escape past the lever or bar by which the contact is operated in each direction.

Operation of Distant-Dial Mechanism.—In the dial mechanism are two iron-clad electromagnets facing each other, and operating upon a rocking arm or lever so that the motion imparted to this will move the dial hand forward on discharge of the battery, and backward on charge, in the same way as the movement of the dial hand on the standard type ampere-hour meter.

In the distant-dial mechanism a new type of zero contact is provided, consisting of a small lever standing at the zero point and connected to a small switch within the dial mechanism, and suitably insulated therefrom. The movement of the lever over a small arc, when the indicating hand comes back to zero, closes the little switch and thus the circuit to the shunt trip coil of a circuit-breaker, as with the standard type ampere-hour meter.

With the distant-dial type meter and mechanism, the meter proper has three main load connections, when of the differential shunted type, as usual in vehicle work, and a small cable consisting of three colored leads for operation of the dial mechanism. From the dial mechanism is brought a cable containing five small leads, three connecting to the leads from the meter, one to the opposite side of the battery from that in which the ampere-hour meter is connected, and the other to the auxiliary receptacle for the trip circuit to the circuit-breaker. The connections between the small leads from the meter and from the dial mechanism may be made at any convenient point beneath the seat, or body of a vehicle, and a suitable junction block can be furnished with the distant-dial meters for this purpose. The various leads from the meter and dial mechanism are plainly identified by color markings, red, blue, yellow, green and black, and the proper connections according to these colors are plainly indicated on instruction sheets and blue-prints accompanying the meters.

An Improved Form of High Voltage Fuse.

As the pressures both on power and lighting circuits increase there is a corresponding increase in the difficulty of effectually extinguishing the arc caused by the rupture of a fuse due to overload and this is especially apparent where comparatively large masses of metal have to be melted or where the power behind the short-circuit is so great that an explosion of greater or less violence is caused by the interruption. It is no uncommon thing to find the protective appartus of a high-voltage electric circuit blown to pieces by the force of the arc owing to the violent action of the safety device itself.

Many devices have been put into operation for minimizing this disruptive explosion and quite a few of these have been particularly successful. A very ingenious application of the temperature co-officient of various metals has, however, been recently invented by Dr. Kallmann, of Berlin, Germany,

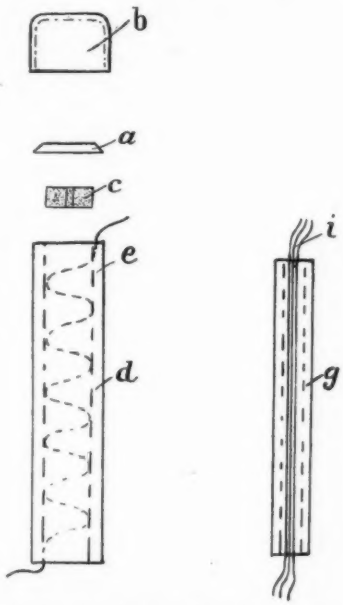


Fig. 1.—Parts of High-Voltage Fuse.

who has developed a form of fuse which should possess considerable interest.

Briefly described, the principle of this fuse consists of placing in parallel with the ordinary fuse wire, which is designed so as to melt at the required excess of load, a small wire of galvanized iron forming a shunt to the ordinary fuse. The operation of this device is as follows: Under ordinary circumstances the current is divided between the alloy and the iron fuse conductors. On excess of current passing, however, the positive temperature coefficient of the iron comes into play, raising its resistance rapidly in relation to that of the alloy wire and thus diverting the main portion of the current through it. This fuse of course, melts and the current is then forced entirely through the comparatively high resistance of the iron-wire fuse and this in its turn melts and finally interrupts the circuit. In this action there are, therefore, instead of one heavy interruption and explosion formed by a homogeneous conductor in the fuse circuit, two interruptions following rapidly one after the other but with sufficient time interval between them

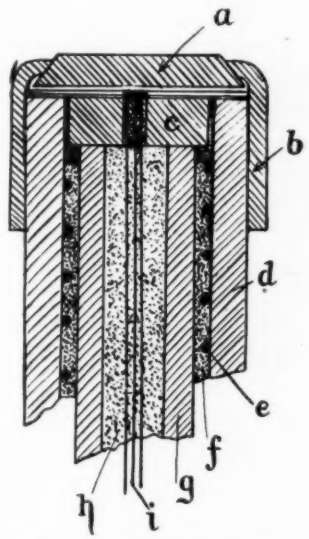


Fig. 2.—Section Through Assembled Cartridge Fuse (Much Enlarged).

to allow of a considerable damping of the force of explosion.

It will be seen that this result can be obtained without any material increase in the size of the fuse and as a matter of fact, owing to the diminished liability of mechanical fracture due to the deferred action of the explosion,

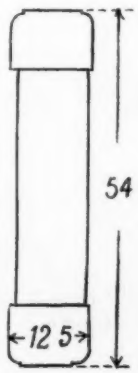


Fig. 3.—25-Ampere Fuse Complete.

it is quite possible that especially on the larger sizes of fuse the mechanical structure need not be stiffened to such an enormous extent as is sometimes necessary with single-explosion fuses. Evidently the principle is one which can be applied to both high and low pressures.

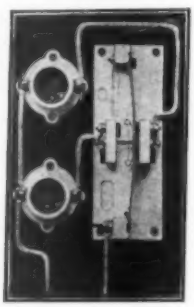
In order to show how in practice this has been worked out several illus-

trations are given of the fuse. Figs. 1 and 2 show the internal construction of the cartridge fuse unit. It consists of an inner and outer insulating tube provided with suitable brass caps *a*, *b*, *c*, at each end. Through the center of the inner tube *g* pass the alloy wires *i* forming the main fuse. while wrapped around in the form of a spiral between the inner and outer insulating tubes is the galvanized-iron wire *e* connected in parallel with the alloy wire. The spaces *h* and *i* within and between the insulating tubes and the fuse wires are filled with sand, pulverized porcelain, or similar metal-vapor-condensing matter. The outer tube *d* is generally made of glass, while the inner tube is made of glass, porcelain, or kaolin. Taking the 20-ampere size, the length of the outer tube is only 49 millimeters (1.93 inches) and its diameter 11 millimeters (0.433 inch), so that the whole cartridge is very compact dimensions. In the 25-ampere size the cartridge from contact to contact measures 54 millimeters and its extreme diameter is 12.5 millimeters. The fuses are made in various capacities and can be used in various types of fuse boxes and cutout devices.

The apparatus has been well tested, and reports which have been received from the Physikalisch Technische Reichsanstalt, of Charlottenberg, Germany, and from the laboratory of the State Electricity Works at Munich, show that the most vigorous tests on comparatively high voltages demonstrated the value of the fuses.

New Thermo-Blink Flasher.

The accompanying illustration shows an automatic thermal flasher with a



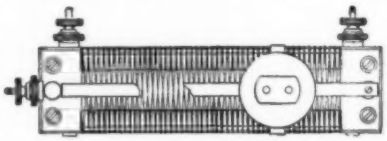
New Thermo-Blink Flasher.

snap make and break. It will switch on first one lamp or circuit of lamps, and then a second circuit, keeping up this alternating as long as the current is on.

This new Thermo-Blink quick-break flasher, just placed on the market by Kelley & Kelley, 105 Liberty Street, Brooklyn, N. Y., is a compact device mounted on porcelain, small enough to go into the window box signs or illusions. No magnets of any kind or spiral springs are used, as will be noted. Many attempts have been made to produce a satisfactory flasher of this type. The Thermo-Blink is the first to overcome all defects, and to produce the results positively in a small flasher.

New Form of Resistance Winding Which is Without Capacity and Not Inductive.

The firm of Gebrüder Ruhstrat, of Göttingen, Germany, has put upon the market a new form of resistance which is non-inductive and free from capac-



Non-condensive and Non-inductive Resistance.

ity effects. The resistance is wound upon the same form which this company already has upon the market, and which has proved such a convenient design for variable resistances. The winding, however, differs in that there are two wires in parallel, which are wound around the block in opposite directions. These neutralize each other as regards induction, and since the winding is continuous from one end of the coil to the other, the capacity is negligible. The two windings are of equal length and symmetrical with respect to one another. To insure that the two wires are of exactly equal length the two opposite surfaces are each provided with grooves. Consequently the two wires are symmetrically arranged upon either side of the point of crossing, and along opposite sides the wires lie parallel to one another and equally distant. These surfaces serve also as the contact surfaces. These resistances may be used not only for regulating rheostats, but also as standard resistances for alternating current. They are said to be especially useful for wireless-telegraph purposes, where high frequencies are used.

Blue-Book Correction.

On page 55 of the 1912 edition of the ELECTRICAL BLUE BOOK, under approved construction material, a transposition of cuts of the cabinets of the Columbia Metal Box Company appears. The illustration appearing above the column headed "Type A" represents the "Type S-W," which is a standard finish in light oak. The cut appearing above the column headed "Type S-W" represents "Type A" which is a standard finish in black japan.

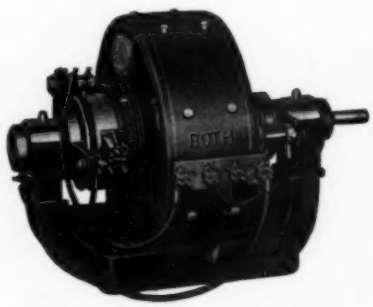
A New Testing Converter.

The rotary converter shown in the accompanying illustration has been placed on the market by Roth Brothers & Company, Adams and Loomis Streets, Chicago, to meet the demand for an efficient machine for testing small motors.

It consists of a type-D frame with extended bearing bracket at each end to admit of both commutator and collector rings on the same armature. This machine has eight poles and is wound for operation on two voltages. Thus, if it operates on 115 volts direct current, it will run at a speed of 900 revolutions per minute and will give 60 cycles alternating current at the collector rings. By running the machine on 230 volts it will have a speed of 1,800 revolutions per minute and give 120 cycles alternating current at the collector rings. Other frequencies can be obtained by speeding the machine up beyond the normal speeds, thus at 1,995 revolutions per minute it gives 133 cycles alternating current. A Cutler-Hammer starter and speed regulator is furnished to obtain this speed variation.

To obtain the proper voltage for testing purposes a transformer is furnished which can be arranged with a number of taps and can also be operated in series or parallel so as to obtain one or more operating voltages. The one provided for most machines is arranged to give 110-volt alternating current at such frequencies as can be obtained from the machine. Several taps are also provided which give small variations from the normal voltages.

Many combinations can be made with this type of apparatus and in many cases two or three machines and sometimes even more are direct-connected



Roth Brothers' Testing Converter.

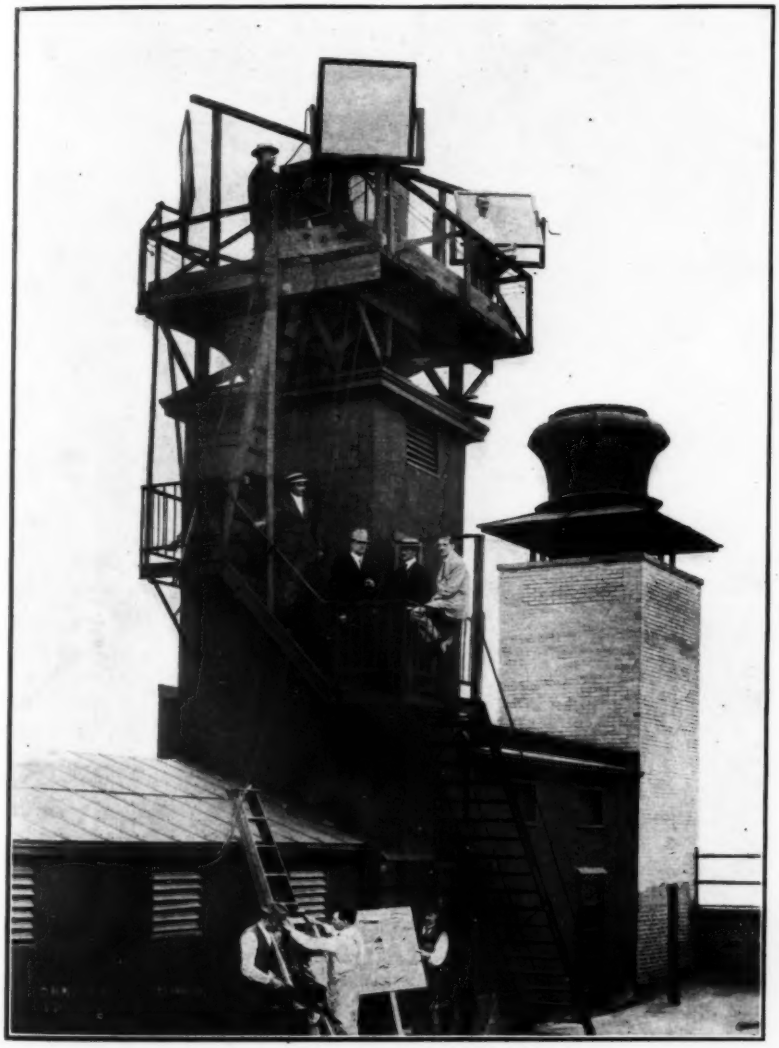
on one bedplate to obtain a number of direct and alternating currents of different characteristics.

The production of coal in Arkansas in 1911 was 2,106,789 short tons, valued at $3,396,849, according to Edward W. Parker, in a statement made public by the United States Geological Survey.

Novel Searchlight Advertising in Baltimore.

National Democratic Convention visitors and all Baltimoreans out on the street after dark, were familiar with the brilliant, startling, ever-changing searchlight effects, in white light and in color, that were flashed nightly from the top of the new Fidelity Building.

The searchlight proper which had been courteously placed at the disposal of The Fidelity Trust Company of Baltimore by the Consolidated Gas, Electric Light & Power Company, was mounted as shown in the picture in the center of a supporting platform. This platform surmounted one of the elevator houses on top of the building. The searchlight thus found a setting on one of the highest points in downtown Baltimore.



Searchlight and Color Projector Designed by Frank L. Perry and Used on Fidelity Building, Baltimore.

The apparatus in its entirety consists of the supporting platform, the searchlight proper, a motor in the base of the searchlight for revolving it, four large light oscillators, or projectors, and the coloring apparatus.

The searchlight proper throws a beam of light 24 inches in diameter. The motor in the base of the searchlight is run by the same source of current that feeds the light, but is independently controlled. The angle of the beam of light may easily be adjusted by hand, and the lamp locked into position by a thumb nut.

It is the arrangement of the four oscillator-projectors, the construction of the projector supports, and the method of coloring the beam with the color apparatus, that are of peculiar interest.

A glance at the picture will reveal that the projectors are located one at each of the four corners of the platform railing. Each projector, or oscillator, is carried by a supporting frame of peculiar construction. These frames are so built that any one or all of the four projector-oscillators may be set at any angle desired relative to the beam of light. Or, any or all of the oscillators may be revolved on the bearings and at the same instant be swung about. In a word, the construction is such as to permit of, so to speak, universal movement.

Directly over the center of the searchlight is hung the horizontally revolving color mechanism. This device produces and varies the four colors in the beam.

With the above brief and general description it is easy to understand how a great variety of light effects may be obtained with this apparatus.

Assume, for instance, that the searchlight makes one turn, horizontally, per minute and that the projectors are set stationary and at a right angle. With the apparatus thus arranged the big white beam would first sweep along horizontally until it struck the first projector-oscillator. It would now begin to split and part of the beam would dart up vertically into the sky. In a moment the entire beam would be projected upward. Then a portion splits off and darts out horizontally, only to be followed in an instant by the full white beam, which then proceeds on its way to the next projector.

With the searchlight thus working automatically in connection with the inclined projectors, the operator now rotates his color mechanism. Instantly the beam, whether horizontal, split or vertical, becomes alive with scintillating varying color.

Further, if the operator so desires, any or all of the projectors may be oscillated so as to throw the beam, as it travels over them, backwards and forwards across the heavens, or any projector may be rotated with the searchlight stationary so as to throw, or swing beam after beam, so to speak, in quick succession across the sky and down on to building, etc. Or the beam, filled with one color, or full of scintillating colors, may be turned to the street to illuminate processions, etc.

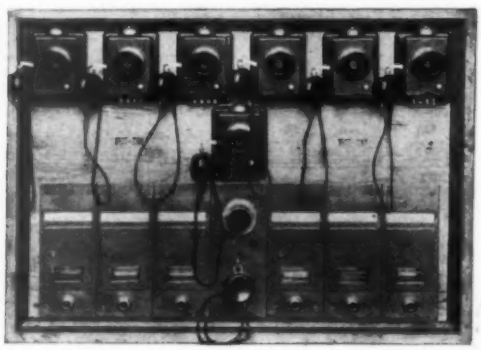
One interesting effect that caused considerable amusement at the time of the night convention parades, was the use of one of these projector-oscillators to illuminate processions on Charles, Saratoga and Lexington Streets. The parade of the Princeton-Wilson men was an instance of this kind. The Princeton men were caught by the orange beam from the Fidelity oscillator at Franklin Street and followed on their march down Charles Street around to the Rennert Hotel and up Lexington Street from

the gas office to the Fidelity Building.

These novel searchlight effects and apparatus were designed by Frank L. Perry, of the executive staff of The Fidelity Trust Company. Superintendent Noah R. Pierson, of the Fidelity Building, and Thomas W. Rogan, were in direct charge of the construction and operation of the apparatus. The searchlight proper was managed during the illumination by Joseph Fischeffer and J. C. Denn, of the Consolidated Gas, Electric Light & Power Company.

Apartment House Telephone Sets.

The increasing number of apartment buildings in nearly all the large cities has called for improved methods of communication that eliminate the shortcomings of the old-fashioned speaking tube. In order to command a high rental, such apartments must be equipped with the most up-to-date appointments of every kind. For both these reasons there has arisen a demand for efficient local telephone sets to connect the main entrance vestibule with each apartment and with the janitor, and also in many cases to permit each apartment to be connected with the janitor. Such an equipment is much more flexible than a speaking-tube system in that it enables the apartment telephones to be readily placed wherever the tenant may desire. It also permits communication



Telephone Set for a Six-Apartment Building.

to be carried on with perfect sound transmission to the most remote apartment.

The Central Telephone & Electric Company, of St. Louis, Mo., has devoted much attention to the development of an efficient and yet low-priced telephone system for apartment houses. The accompanying diagram shows one of these sets as adapted for a six-apartment building. It has a wall telephone set in each apartment, one in the janitor's room and one in the middle of the letter-box group. These six-apartment buildings are becoming very popular in the large central cities and a good demand has arisen for the type of set shown. The entrance telephone and letter boxes are usually of brush-brass finish, but in any case harmonize with the metal finish of the entrance. In the apartments themselves the telephones are of black-enameled steel with nickel trimmings, which finish harmonizes with practically any room decoration. Special sets are made to include an annunciator for the janitor. Other special requirements can be readily provided for, regardless of the size of the building. A blue print of the connections is furnished with each set to enable any contractor or wireman to install the equipment. A valuable feature of the set is that at a relatively low increase in cost over the speaking-tube installation a thoroughly up-to-date, efficient and flexible system is obtained.

A New Preservative Material for Timber.

The preservation of timber, especially in the form of poles for line construction, is becoming every year more important, and a variety of preserving materials are now upon the market. The most valuable materials for this purpose are those which form an insoluble compound with the cellulose. Soluble salts will gradually be leached out of the wood and lose their preservative effect. A new preservative material which obviates this defect has recently been brought out under the name of "Aczol." This is a patent compound of metallic ammoniates with an antiseptic acid, having no deleterious action on wood or metals.

It is claimed that this material has considerable advantages over the use of copper sulphate. It is not superior to creosote as regards preservative value, but has advantages in cost, permanence, lightness, cleanliness and non-inflammability of the treated wood. The mechanical strength of the wood is materially increased by the treatment. Wood impregnated with Aczol can be painted or polished when dry. The fluidity of this material enables it to be applied cold, whereas creosote and other tar products require heat during injection.

New Large-Capacity Motor Starting and Regulating Controller.

A new type of controller for medium and large-capacity direct-current motors has been placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. This controller consists of a multiple-switch starter and a shunt-field type speed regulator. The starting portion is similar to the standard Cutler-Hammer multiple-switch starter designed for use with large motors or with motors of medium size when the starting conditions are severe. Each of the individual levers, when closed, cuts out a step of armature resistance bringing the motor up to normal speed. The field-regulating rheostat mounted above, as shown in the illustration of a 50-horsepower, 230-volt type, consists of a series of field-resistance steps controlled by a single lever.

Motor Starter and Speed Regulator.

When the motor has been properly accelerated to normal speed by cutting out the armature resistance, the field-regulating resistance may then be used to secure further increase in speed. If the main-line switch is opened or the current supply interrupted, the no-voltage release on the starter opens the starting switches and this, in turn, de-energizes the no-voltage release of the field rheostat, causing the lever to return to the "full-field" position. The motor is, therefore, thoroughly protected.

Space-Saving Switchboard Meters.

The increasing size of modern power developments and the growing scarcity of available space, particularly in large cities, have emphasized the need of compactness in switchboard design. The desirability of having all the meters in plain view of one operator has long been appreciated, and this requirement necessitates not only that the meters shall occupy a minimum of space, but at the same time they must be easily readable so that all can be read from a common point. In many plants, in congested districts, the switchboard is located in a poorly lighted place, which imposes the further requirement that the meter dials be capable of thorough illumination.

To accommodate and encourage these strongly defined tendencies in switchboard design, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a complete line of seven-inch, round-type switchboard meters. The size of these meters is such that three of them can be mounted in a horizontal row on a 24-inch panel, or two in a row on 16-inch panel. While the resulting saving for one panel is small, the same saving carried out in a whole switchboard amounts to considerable proportions. This is borne out by the switchboard installation at the Mare Island Navy Yard, which was described in these columns in the issue of June 8, 1912

A feature of a board of the character of that noted is the uniformity of appearance of all the meters. The Westinghouse line of seven-inch meters includes alternating-current ammeters, voltmeters, single-phase and polyphase wattmeters, frequency meters, power-factor meters, and synchroscopes, also direct-current ammeters and voltmeters.

It is evident that the saving in space would mean nothing if the meters were not as easy to read as larger meters. In reality they are as easy to read as the Westinghouse 9-5 inch meters, and easier to read than any other meters because of the length of their scales, the flat open faces, which permit thorough illumination, and visibility of the entire pointer, and the intense damping of the pointer.

The true measure of a meter's "space efficiency" is not alone the area it occupies but really the length of scale per square inch of area occupied. A meter that occupies less area but requires the operator to be closer or to move about in order to take a satisfactory reading saves little, as the number of meters that can be placed within range of the operator's vision from a given point remains the same. If, however, the same scale can be had in a smaller meter, the condensation of space is a distinct advantage. This result is obtained with the Westinghouse seven-inch meters.

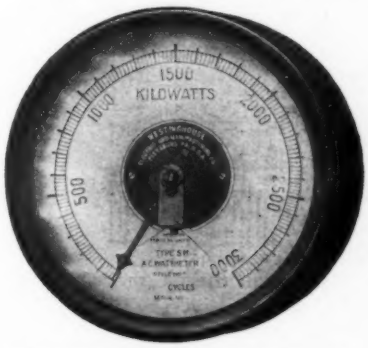
A glass cover instead of a metal cover with a slot in it is a feature the advantages of which have been realized for some time in European practice. The possibility of good illumination can be easily appreciated. As economy of space is most important in congested districts where poor illumination is the rule, the necessity of making the best of the illumination obtainable is evident. Added to this is the fact that the pointer, being wholly visible, can often be read by its position, like the hands of a clock. This feature is particularly valuable in immediately detecting overloads, or variations in voltage, frequency, or power-factor on corresponding meters.

The meters are "superdamped"; that is, the damping is such that the pointer does not overswing and return to the true reading but comes up to the true reading and stops. Even a variation in load equivalent to full scale will not cause the pointer to overswing. This result is accomplished in the alternating-current meters, where it is especially important, by magnetic damping; —an aluminum disk moving in the concentrated field of two permanent magnets.

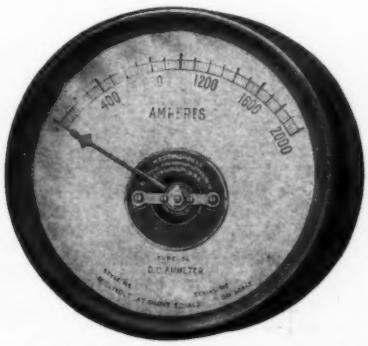
The clearances of the magnetic dampers, as well as the air gaps of the movements, are large, and accidental friction from this source is thus rendered almost impossible. The whole construction of the meter is simple and rugged, so that the initial accuracy is maintained for long periods; and repairs, when necessary, can be made by the average central-station attendant without sending the meter back to the factory.

Seven-Inch Induction-Type Voltmeter.

Seven-Inch Synchroscope.



Seven-Inch Induction-Type Wattmeter.



Seven-Inch Direct-Current Ammeter.

Multistage Centrifugal Air Compressors as Blowing Engines

The General Electric Company, Schenectady, N. Y., has developed a very compact multistage centrifugal air compressor capable of handling large volumes of air. It has been found particularly serviceable in place of the ponderous blowing engines heretofore found necessary in supplying the blast for blast furnaces in iron and steel works. The principal advantages of this type of compressor are great savings of floor space, net weight, oil supplies and maintenance, and excellent control of required volume of air against whatever pressure may be required in the operation of the blast furnace. This close control of air is accomplished by a constant-volume governor, which is one of the unique features of these blowing engines.

Within the last month the company has received the following orders for multistage centrifugal air compressors for service as blast-furnace blowers:

One 25,000 cubit foot per minute, 15 to 25-pound compressor driven by a

high-pressure steam turbine from the E. & G. Brooke Company, Birdsborough, Pa. One 13,000 cubic foot, 16 to 25-pound compressor driven by a mixed-pressure turbine, Chattanooga Coal & Iron Company, Chattanooga, Tenn. Three 40,000 cubic foot, 15 to 30-pound compressors driven by high-pressure steam turbines, Woodward Iron Company, Woodward, Ala. The General Electric Company has six multistage compressors already installed as blast-furnace blowers.

New Type of Quartz Mercury-Vapor Lamp.

At the meeting of the French Physical Society on June 21, a new type of mercury-vapor lamp was described by E. Darmois and M. Leblanc. The previous forms of quartz lamp have presented difficulties owing to trouble in sealing-in the electrodes. Moreover the lamp has been unsymmetrical with respect to the two electrodes since the intense heat generated at the anode has caused the principal vaporization to take place at this point. Lamps have been constructed for voltages only up to 220 volts.

These objections have been eliminated in the new type of lamp, which is due to two English engineers, Messrs. Kent and Lacell, of the Silica Syndicate of London. The details have been worked out in the laboratories of the Westinghouse-Cooper Hewitt Company at Suresnes.

The lamp consists essentially of a tube in the form of a horseshoe which contains the arc. The apparatus is filled with mercury and is open to the air at the two extremities where the conducting leads bring in the current. The arc is struck with the aid of a platinum resistance situated near the middle and outside of the arc; the heat produced by this resistance brings the mercury to the boiling point; the thread of mercury is thus broken and the arc strikes across, driving the mercury back to the two terminals. A special arrangement depending on the motion of the mercury permits the heat to be carried away from the circuit without interfering with the illumination.

The two electrodes, which are situated below the arc formed by the tube, are connected. The nearness of the anode and the cathode causes the vaporization of the mercury to be equal and the lamp is thus symmetrical and without polarity.

This lamp has been constructed for circuits of 500 volts; it consumes 1.2 to 1.5 amperes and gives 1,500 candlepower. By the use of automatic regulating resistances, thus cutting down the efficiency of the lamp, it can be operated upon 220 volts. The lamp can then be made stable for a drop in potential of 10 per cent.

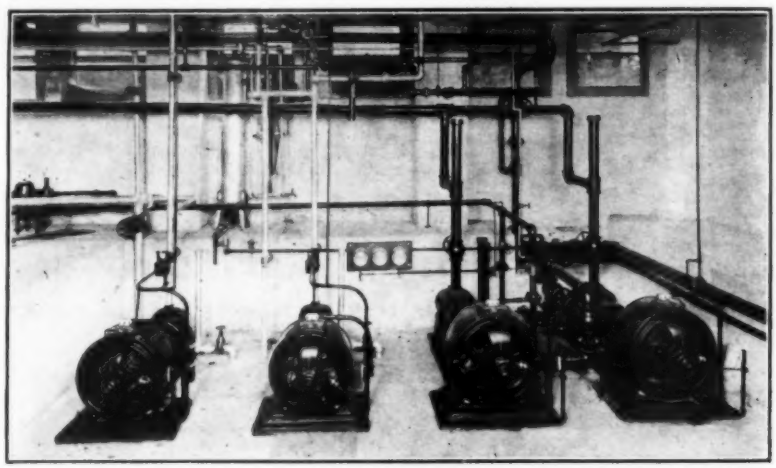
Use of Telephone for Determining Motor Speed and Brush Condition.

The view of the motor installation here reproduced, shows a unique and original use of the telephone transmitter. The view is that of four Fort Wayne direct-current motors driving pumps in connection with the heating and water system of the general office building of the Fort Wayne Electric Works, Fort Wayne, Ind.

The motors are controlled from a general switchboard remotely located, and it was desirable that the engineer in charge at the switchboard should have some way of knowing whether or not the motors were working properly without going all over the building to the location of each one to find out. To accomplish this, each of the motors has been supplied with a telephone transmitter, with the mouthpiece placed quite close to the commutator of the motor, each transmitter having its individual telephone circuit terminating in plug receptacles at the switchboard.

When the engineer wishes to start up a motor or adjust the speed, he plugs a telephone receiver into the terminating receptacles in the board, and is able to tell if it is operating properly by the pitch of the humming sound which the brushes of the motor make in passing over the commutator bars, the pitch of the sound becoming higher as the speed of the motor is increased.

Every motor used in connection with the water, heating and ventilating systems in this modern office building is equipped with a telephone transmitter. By this method the speed of the large exhaust fan motor located on the roof of the five-story building is quite as easily noted and controlled as those which operate pumps in the basement. In fact, the experienced engineer can control the speed of any of the motors quite as accurately and as easily as if the dial of a mechanical speed indicator were registering the speed directly before his eyes. Should there be any sputtering or chattering of the brushes, this would be readily detected by the telephone.



Use of Telephone Transmitters Adjacent the Commutators of Pump Motors, Fort Wayne Electric Works.

Unmagnetizable Steel.

On July 9 there was issued to Friedrich Kohlhaas, of Dusseldorf, Germany, a United States patent on a composition of steel that is substantially unmagnetizable. It contains about 9.8 to 10.3 per cent of manganese, about 0.9 to 1 per cent of carbon, about 0.2 to 1.4 per cent of titanium and not to exceed 0.8 per cent of silicon, 0.03 per cent of sulphur and 0.015 per cent of phosphorus. The patent, which is Reissue No. 13,440, has been assigned to the corporation International Steel, Limited, of Birmingham, England.

Milwaukee School of Engineering.

The School of Engineering, of Milwaukee, Wis., has issued its prospectus for the year 1912-1913, which calls attention to the establishment of two new courses—a one-year course covering the requirements to become a practical electrician, and the electrical engineering course which includes the other but requires three years for completion. It contains all the essential features of an electrical engineer's course, eliminating mathematics and theory not required in the daily work of the practicing engineer. The attendance at the school during the past year was 210.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MOVILLE, IOWA.—Bonds were voted for an electric light plant. C.

BELMOND, IOWA.—The council has taken steps for a better lighting system. C.

WINNEBAGO, MINN.—Efforts are being made to secure cluster lights for Main Street. C.

MADISON, MINN.—Bonds for $50,000 were voted for improving of the electric light plant. C.

HAVERHILL, MASS.—This town is considering the installation of improved street lighting.

BLUFFTON, IND.—The City Council is endeavoring to dispose of the municipal lighting system.

BELCHTOWN, MASS.—A movement is on foot here to provide the town with electric lights.

NATCHEZ, MISS.—This city is proposing to construct its own electric light plant for street lighting only.

TUCSON, ARIZ.—A St. Louis corporation has applied for a franchise to establish an electric light plant here.

MINNEOTA, MINN.—The electric light company at Canby offers to build a power line to this city to furnish light. C.

GARRETTSON, S. D.—At a special election bonds were voted for the installation of an electric light system here.

KATONAH, N. Y.—The Katonah Lighting Company will make extensions to South Salem, Poundredge and Bedford.

CHAMPAIGN, ILL.—A contract is soon to be let for a new street-lighting system for which initial bonds will be issued.

BLACKSHEAR, GA.—This city has voted bonds to the amount of $55,000.00 for a system of electric lights, water and sewerage.

COOLIDGE, KY.—This town is to have an electric light plant. F. D. Samsson, circuit judge, has the matter in charge. G.

FREDERICK, MD.—The Frederick & Hagerstown Power Company will construct a power line from its plant at Security to Thurmont.

HILLSBORO, TEXAS.—The Texas Power & Light Company will expend $30,000 remodeling its plant in this city and making extensions.

CADOTT, WIS.—An ordinance has been passed authorizing the construction of an electric power plant for which bonds will be issued.

RICHMOND, VA.—The Richmond & Henrico Railway Company has been granted a franchise to engage in the sale of electric light and power.

DES MOINES, IOWA.—It is proposed to erect a combination electric light and heating plant to cost $400,000. W. B. Storkey is interested. C.

MARSHALLTOWN, IOWA.—An electric power line will be constructed from here to Toledo, connecting also with Quarry, LaGrand and Montour.

PORTLAND, ORE.—The Northwestern Electric Company is seeking a franchise for a plant here to furnish heat, light and power to consumers.

JOHNSTOWN, N. Y.—A street-lighting system has been decided upon consisting of 50 posts each carrying four 60-watt lamps and one 100-watt lamp.

ALBUQUERQUE, N. M.—The Artesia Light & Power Company has advertised for bids for the installation of the first unit of a series of additions to the local plant.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company is about to construct a new substation costing $30,000 at the corner of Eighth and Dauphin Streets.

McMINNVILLE, TENN.—The Ottawa Water & Power Company will likely enlarge its plant, an increase in its capital stock from $50,000 to $75,000 having been provided. G.

HENNING, ILL.—Preparations are being made to install electric lights in this town. The supply line is to be extended from Potomac and a contract will soon be let for the work.

SENECA, KANS.—The towns of Oneida and Axtell are to install street-lighting systems and will be furnished current from this city. Both towns have voted bonds for the purpose.

PIERZ, MINN.—An electric transmission line is to be constructed from Little Falls to this town, a distance of 15 miles. The central station in Little Falls will supply the power.

MARIETTA, GA.—This city will close down its electric power plant and buy power hereafter from the Georgia Railway & Power Company, which is building a transmission line through Cobb County.

MEXICO, MEX.—The Tampico Elecric Light, Power & Traction Company has purchased the power plants of the Fuerza Electric and J. F. Borde Company and plans to install a modern power station.

ROSEBURG, ORE.—The electric lighting plant here has been bought by A. Welch. It is intended to make extensive additions to the present system and extend the service over considerable territory.

MADISON, WIS.—An issue of $50,000 of bonds has been voted by the citizens to be used for water works and improving the electric light system. $20,000 will be spent on the electric light plant.

TACOMA PARK, MD.—The Potomac Electric Power Company is about to install a street-lighting system in this town, and supply current therefor. One hundred lamps of 40 candlepower each will be installed.

VICKSBURG, MISS.—Chicago parties are considering the purchase of the Vicksburg Electric Railway & Electric Lighting Company. If the deal goes through the plant will be greatly improved and additions made.

OBERLIN, O.—Control of the Oberlin Gas & Electric Company, which has been in financial trouble, has been secured by the Light & Development Company of St. Louis. This company will rehabilitate the property.

PHILADELPHIA, PA. — A 1,000-horsepower electrical plant will be installed in the new Hotel Adelphia for the purpose of running an elaborate cooling and ventilating system and other mechanical apparatus.

LEXINGTON, KY.—The Kentucky Traction & Terminal Company proposes to extend its power distribution lines out into the surrounding country. These extensions will follow the various turnpikes entering the city.

AMERICUS, GA.—The Americus Power Company is about to award a contract for the erection of a power plant in this town, to be ready for service in October. The company has been awarded the city lighting contract.

KENSINGTON, MD.—This town will soon have its streets lighted by electricity, power to be furnished by the Potomac Electric Power Company, of Washington, D. C. About 60 lamps of 40 candlepower each will be installed.

LAPORTE, IND.—Business men in this town are awakening to a realization that the city needs better lighting, and a movement is on foot to secure it. It is proposed to install special lamps in Main Street, Indiana Avenue, and Michigan Avenue.

MORRISTOWN, TENN.—The Morristown Power & Development Company has secured a franchise and will construct a power plant which will supply the Morristown Interurban Railway Company, as well as do a general lighting and power business.

LOGANSPORT, IND.—Plans for lighting Riverside Park have been completed by Superintendent Joseph Stewart, and the installation will be made at once. Lamps of 350 candlepower will be placed 200 feet apart. The wiring will be entirely underground.

FULLERVILLE, N. Y.—The Fullerville Power Company will construct a hydroelectric plant in this village and will supply power to the Ontario Talc Company and the Northern Ore Company. Anson A. Potter and Jerry Finch, of Gouverneur, are the principal stockholders.

STEWARTSVILLE, MO.—An electric light franchise has been voted and the installation of a power plant will soon be begun.

PALESTINE, TEX.—The White Way Committee of the Young Men's Business League is discussing plans to get this town better street lighting. The White Way will soon be installed.

COLFAX, IOWA.—A twenty-year franchise has been granted to the electric light company with rights to operate over the streets and alleys of the town. The company will do both a lighting and heating business and developments and extensions will be immediately made.

HINTON, OKLA. — Kennedy & Fleming, of Oklahoma City, have been working on preliminary estimates for city officials of Hinton, on a municipal electric light plant, which it is proposed to build here. A call will be issued in the near future for an election to vote bonds for that purpose. P.

ST. ELMO, TENN.—This town is arranging for the installation of a street-lighting system. It will probably be put in by the Chattanooga Railway & Light Company. The business league of St. Elmo has the matter in charge. H. E. Dagley is vice-president. G.

BOWLING GREEN, KY.—The Barren River Power Company has been organized with $10,000 capital stock and will build a water-power plant at Brown's Lock for the purpose of furnishing current for the operation of stone quarries in the Bowling Green district. John Oman is the principal stockholder of the company. G.

JOHNSON CITY, TENN.—The East Tennessee Electric Company, which was recently incorporated, intends to construct a hydroelectric plant on the Nolachucky River at a cost of $500,000. Transmission lines will be built to Greenville, Johnson City, Morristown, Jonesboro and Erwin.

VICKSBURG, MISS. — Improvements in the plant of the Vicksburg Railway & Lighting Company are to be made by Chicago interests which have taken it over. They are represented by I. C. Elston, Jr., and W. B. Walker. W. B. Moorman, general manager of the company will retain his position. G.

SAN FRANCISCO, CAL.—The Oro Electric Corporation has secured permission from the State Railroad Commission to build a power plant on Yellow Creek and construct a transmission line from that point to Alameda County and Calaveras County. The lines will later be extended into other neighboring counties.

EDINBURG, IND.—The Interstate Electrical Company is planning to construct power houses at the Blue River and Furnas mills at a cost of $150,000. Farm houses and the towns within a radius of thirty miles from Edinburg will be supplied and citizens of Brown County have requested that the line be extended in that direction.

NORTH BROOKFIELD, MASS.—The North Brookfield Electric & Power Company has been formed to take over the franchise recently granted for an electric light and power business. The new company is identified with the interests back of the Central Massachusetts Electric Company of Palmer. The president of the new company is E. D. Royell of Plymouth, and the general manager is H. M. Parsons of Palmer.

SAN FRANCISCO, CAL.—Permission has been granted the Pacific Gas & Electric Company to construct two new hydroelectric plants on Bear River in Placer County, and build a power line from them to a point near Crockett on San Francisco Bay. The company will install four 10,000-kilowatt generators, and later increase the output to 100,000 kilowatts. About $5,000,000 will be required for the first unit of the work.

JOHNSTOWN, PA.—Six companies are being formed here to operate light, heat and power plants throughout Cambria County. Extensive power houses will be built and distributing lines constructed through the coal-mining section. Power will be supplied to mine plants, as well as for town lighting and industrial plants. The companies concerned are the Cambria Light, Heat & Power Company; the Chess Creek Light, Heat & Power Company; the Carr Light, Heat & Power Company; the Moss Creek Light, Heat & Power Company; the Red Top Light, Heat & Power Company and the Sterling, Light, Heat & Power Company. These interests are identified with the Penn Central Light & Power Company, of Johnstown.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ST. CLOUD, MINN.—The Tri-State Telephone & Telegraph Company seeks a franchise. C.

VIKING, MINN.—The Viking Telephone Company will build a line to Thief River Falls. C.

OTTAWA, O.—The Putnam Telephone Company has increased its capital stock to $125,000.

LA PORTE, MINN.—The La Porte & Yola Telephone Company will overhaul and improve its line at once. C.

GRAMPIAN, PA.—The Grampian Hills Telephone Company has been incorporated with a capital of $5,000.

ADAMS, N. D.—Ole Swedberg received the contract to build the Silvesta Adams Farmers' Mutual telephone line. C.

BRUNNERSVILLE, PA.—The Elizabeth & Warrick Telephone Company has been incorporated with a capital of $5,000.

ALBION, WASH. — The Pacific States Telephone Company has asked for a franchise to install a switchboard in this city.

WYMORE, NEB.—A citizens' meeting has decided to install an independent telephone plant in this town with local capital.

TAMPICO, MEX.—S. Pearson & Sons have applied for a concession for the construction of a wireless telegraph station at this city.

PASADENA, CAL.—Bids will be received up to August 19 for a 40-year franchise for a telephone and telegraph system over all streets of this city.

NEWBURYPORT, MASS. — Plans are under way for installing telephone lines in this town, the New England Telephone Company being interested.

RICHMOND, VA.—The Southern Bell Telephone & Telegraph Company is to build a new branch exchange at Robinson Street and Floyd Avenue.

BELLE PLAINE, MINN.—A new 100-line-capacity switchboard will be added to the telephone exchange of the Citizen's Home Telephone Company. C.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has plans for improvements to its exchanges at Wauwatosa and Lake, costing $4,300 and $6,300. C.

SOUTH BEND, IND.—At the annual meeting of the board of directors of the Willapa Harbor Telephone Company it was decided to build a new line from this city to Bay Center.

HEUVELTON, N. Y.—The Heuvelton Telephone Company has been incorporated with a capital stock of $25,600. The incorporators are Webster L. Wainwright, Naomi N. Wainwright and S. M. Wainwright.

WEDOWEE, ALA.—The Wadley Telephone Company has been incorporated with a capital of $2,000. The incorporators are J. W. Walsh, C. W. Thompson, H. L. Simpson, C. G. Crowley, H. D. Pierson and others.

PORT ARTHUR, TEX.—The South Texas Telephone Company is considering the extension of telephone construction work in this city. R. S. Shelby, of Austin, is manager. C. J. Davidson is in charge of the work.

DEVILS LAKE, N. D.—Frank E. Coreson has been granted a 30-year franchise for operating a telephone, electric light and waterworks plant. The new company will take over the plant of the Devils Lake Improvement Company.

PEKIN, ILL.—The Washington Home Telephone Company has been incorporated to construct a telephone system in Washington and vicinity. The capital stock is $45,000. The incorporators are E. S. Sterritt, C. A. Camp and C. B. Cheadle.

NEW YORK, N. Y.—The Metropolitan Telephone & Telegraph Company has been incorporated under the laws of Delaware with a capitalization of $3,000,000. The organizers are C. H. Stillman, of New York and H. Lee Sellers of Montclair, N. J.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ELKHART, IND.—A movement is on foot to build an interurban railway between Elkhart and Nappanee.

MOOREHEAD, MINN.—H. M. Byllesby & Company has secured a franchise for the extension of a car line to Dilworth. C.

SCALES MOUND, ILL.—It is proposed to run an interurban through this town from Plattsville, Wis., passing through Cuba City, Benton and White Oak.

ZANESVILLE, O.—Pittsburgh capitalists are planning the construction of an electric line between Zanesville and Cambridge. If a right of way can be secured at a reasonable figure the line will be built at once.

GRAND RAPIDS, MICH.—Recent real-estate transfers in this city indicate that the projected railway between Grand Rapids and Kalamazoo soon to be realized. J. W. Spooner is prominent in the negotiations.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern will

build an electric line from Brandon to Urbana. C.

NEW ORLEANS, LA.—An extension of the Morgan-Patterson car line to Algiers has been promised in the near future.

COLTON, CAL.—Bids will be received up to July 31 for the right to construct an electric railroad on certain streets of this town.

CEDAR RAPIDS, IOWA.—The Cedar Rapids and Marion Street Railway has changed hands and extensive improvements will be made. C.

BEAUMONT, TEXAS. — Surveys have been made for an interurban line between this city and Port Arthur, and construction work will be started as soon as a franchise is secured.

MONONGAHELA, PA.—The West Penn Company proposes to build a trolley line from Monongahela to Washington. The necessary franchises have been secured.

TOPEKA, KANS.—The work of extending the Strang electric line from Olathe to Topeka will begin this summer. Financial arrangements have been completed.

PLEASANT HILL, ORE.—An extension of the Oregon Electric Railway to this town is being urged and the Commerical Club is taking an active part in formulating plans.

LOS ANGELES, CAL.—Citizens of the northwestern part of the city are urging the extension of the Los Angeles Railway Company through Elysian Park to Griffith Park.

SHEBOYGAN, WIS.—Surveys have been made for the construction of an electric interurban line to Manitowoc, 26 miles. L. K. Fitz, of Manitowoc, made the survey for undisclosed principals. C.

ATLANTA, GA.—It is rumored that the promoters of the Piedmont System of North Carolina who are covering that district with a network of railways, will extend their lines to this city.

SAN BERNARDINO, CAL.—The Chamber of Commerce is working to secure funds with which to provide the Pacific Electric Company with a shop site here and a right of way into the city.

TECUMSEH, OKLA.—The Rapid Transit Interurban Company which has started the construction of a line south from Tecumseh, is planning to also build a line west to Oklahoma City.

MORRISTOWN, TENN.—The Morristown Interurban Railway Company proposes to build a number of interurban railway lines out of Morristown. The charter of the corporation has been secured.

DULUTH, MINN.—The Duluth Street Railway Company has been asked to extend a line to the cemetery. A line will be built to the steel plant as soon as the streets and bridges are in shape. C.

CLAIRTON, PA.—A street-car line between Clairton and Dravosburg will be built within six months according to J. E. White, one of the directors. The line will eventually be extended to West Elizabeth.

BRISTOL, TENN.—It is proposed to extend the line of the Johnson City Traction Company to this city, a distance of 25 miles. This property is now owned by the Tennessee & Eastern Electric Company.

CHEYENNE, OKLA.—Work is to be started in the near future on the construction of a six-mile stretch of road from Cheyenne north to the connection with the Clinton and Oklahoma Western Railway.

ST. AUGUSTINE, FLA.—Right of way to the St. Johns Electric Company has been given for constructing an extension along the San Sebastian River into New Augustine. A franchise has also been secured by the company.

BOSTON, MASS.—The Boston & Eastern Electric Railway Company is making arrangements for financing a new road, the cost of which will be about $12,000,000. As soon as this can be done construction work will proceed.

NEWCASTLE, IND.—The extensions of the Newcastle & Eastern Traction Company between Muncie and Newcastle will be constructed during the coming year. The survey has been completed and an extension is planned later to Richmond.

SHREVEPORT, LA.—The Shreveport Traction Company has been granted a franchise by vote of the people of the city to construct two electric street-railway lines. One is to run to and through the suburb of Allendale and the other to the city park. D.

HOMESTEAD, PA.—The Duquesne & Dravosburg Street Railway Company has planned to build a branch into this town and on to Pittsburgh by way of the south side. Connection will probably be made with the Homestead and Mifflin line at Lincoln Place.

DES MOINES, IA.—It is reported that the Des Moines, Perry Interurban Company, is planning a line from Woodward to Ogden. The Greater Des Moines Committee has circulated a petition for a vote on a special tax to build an interurban to Red Oak. C.

TUSCALOOSA, ALA.—An electric street railway will be constructed by the Tuscaloosa Ice & Light Company as soon as the franchise is granted. A petition looking to this grant has been signed by a large number of prominent citizens and property owners.

DENTON, TEX.—The Chamber of Commerce of this city has received a proposition from prominent Fort Worth business men to construct an interurban line between the two cities. Right of way must be furnished and a certain part of the capital stock taken.

BROWNWOOD, TEX.—The Texas Light and Power Company, of Dallas, has purchased the holdings of the Brownwood Gas and Electric Company, the consideration being $100,000. It is announced that the new owners will construct an electric street-railway system here. D.

CLEVELAND, O.—The Cleveland, Painesville & Eastern Railway will complete its line into Erie and probably later extend to Buffalo. This result is due to the inability to make arrangements with the Pennsylvania & Ohio Traction Company for through service over its lines.

PORT CHESTER, N. Y.—The construction of the White Plains-Ossining end of the Hudson River & Eastern Traction Company will start some time this summer. Francis A. Stratton, who is the promoter, has finally had his franchise approved by the Public Service Commission.

MARSHALLTOWN, IOWA.—Cedar Rapids capitalists, headed by W. G. Dows, have been granted franchises for street-car extensions here and the work of improvement will go forward immediately. An option has been secured on the Jones and Hovey Gas Electric & Street Railway property.

SAN BENITO, TEX.—The San Benito & Rio Grande Valley Interurban Railway Company has been incorporated with a capital stock of $500,000. A line is to be built in the Rio Grande Valley in Cameron and Uvalde Counties with a large number of branches, the total length approximating two hundred miles.

ENID, OKLA.—The receivership sale of the Enid, Ochiltree & Western Railroad will result in the completion of the construction work on that line which was started two years ago. This road will pass through Cherokee and Woodward in Oklahoma and Dalhart, Tex. A connection will probably be made with Guthrie.

SAN FRANCISCO, CAL.—The Supervisors have passed a resolution directing the Board of Works to give estimates of the cost and submit plans for the extension of the Geary-Street road from Kearny Street to the outer tracks of Market Steet, opposite Sansome, and from Thirty-third Avenue to the beach. D.

PATERSON, N. J.—Work will soon be started on an electric line from here to New York City, at a cost of about $18,000,000. The line will be partly overhead and partly underground. The right of way of the New York & North Jersey Rapid Transit Company has been secured. Thomas P. McKenna and Malcolm G. McAdoo, brother of the tunnel builder, are actively interested.

NEW INCORPORATIONS.

RACINE, WIS.—The Racine Electric Company has increased its capital from $10,000 to $25,000.

CENTERVILLE, MICH.—Centerville Water & Electric Company has incorporated with a capital of $10,000.

PLYMOUTH, PA.—The Stroudsburg, Conshocken Power Company has been incorporated with a capital of $5,000.

CAMDEN, N. J.—The Long Beach Electric Light & Power Company has been incorporated with a capital of $50,000.

DELAWARE WATER GAP, PA.—The Delaware Water Gap Electric Company has been incorporated with a capital of $5,000.

HARLEM, MONT.—The Harlem Electric Light & Power Company has filed articles of incorporation. Peter Mitchell is president.

SEATTLE, WASH.—The Western Power Company has been incorporated with a capital of 1,000,000 by A. W. Wing, Horace A. Wilson and others.

PORTLAND, ME.—The General Gas and Electric Company has been organized with an authorized capital of $20,000,000. A. F. Jones, of Portland, is president.

MONMOUTH, ILL.—The Monmouth Power & Light Company has

been incorporated with a capital of $10,000 by J. W. Walsh, John J. Ryan and Paul Wagner.

SUNSET HEIGHTS, TEX.—The Sunset Water & Power Company has been incorporated with a capital of $20,000 by Richard Rodgers, R. R. Harden and C. G. Dougherty.

STIGLER, OKLA.—The Stigler Ice and Electric Company has been incorporated with $45,000 capital. The incorporators are R. L. Coleman, G. A. Holley, Ulys Pyle, Mary L. Coleman and Carl Pyle, all of Stigler. P.

SYRACUSE, N. Y.—The Central Light & Water Company, with a capital of $10,000 has been incorporated by Arthur McCausland, Harold S. Brown, and R. W. Yates, all of New York.

CHICAGO, ILL.—The American Safety Valve Company, with a capital of $300,000, has been incorporated by N. P. Bigelow, L. T. Walker, and C. L. Sentz, to carry on a manufacturing business in electrical machinery.

FINANCIAL NOTES.

Despite the complexity of the political situation the expected depression resulting therefrom has not been materially in evidence. On the contrary, sober reflection on the trend of events has brought about a hopeful outlook in many quarters. It is felt that the principle of the genuine "square deal" is not confined to any one party or group and that unchecked radicalism is not at all likely to prevail. A number of large electrical companies are reporting brisk business. A prominent electrical manufacturer states that "we are receiving orders not only for more machinery, but for larger machinery, which is an indication that the capacity of modern electrical plants is being increased. This activity in the electrical business implies a corresponding activity in practically every other industry where power is used since there is scarcely one of them which does not apply electric power in one form or another to part or all of its plant."

Directors of the New England Telephone Company have authorized an issue of 39,178 shares to be offered at par to stockholders of record July 20, in the ratio of one new share for each ten held. Rights expire August 31. Subscriptions must be filed before August 31. Payment in full is to be made September 12.

A trust deed for $10,000,000 has been filed in favor of the Camden Trust Company, Camden, N. J., to secure a bond issue for construction of the Indianapolis, Chicago & Meridian Electric Railroad, 156 miles long, being the shortest distance between Chicago and Indianapolis. Construction work has already begun.

Dividends.

Binghamton Light, Heat & Power Company; the regular quarterly dividends of 1.5 per cent on the preferred stock, payable July 15 to stock of record June 29; and of 0.75 per cent on the common stock, payable July 15 to stock of record June 29.

Butte Electric & Power Company; a regular quarterly dividend of 1.25 on the preferred stock, payable August 1 to stock of record July 20.

Columbus Railway Company; a quarterly preferred dividend of 1.25 per cent, payable August 1 to stock of record, July 15.

Electric Bond & Share Company; a regular quarterly dividend of two per cent on the common stock and 1.5 per cent on the preferred stock. Common dividend is payable July 15 to stock of record July 13. Books do not close. Preferred is payable August 1. Books close July 19 and reopen August 1.

Electric Company of America; a dividend of thirty cents per share, payable August 1 to stock of record July 13.

Grand Rapids Railways Company; a quarterly preferred dividend of 1.25 per cent, payable August 1 to stock of record July 15.

Railways Company General; a quarterly dividend of one per cent, payable August 1 to stock of record, July 20.

Sayre Electric Company; the regular quarterly dividends of 1.5 per cent on the preferred stock, payable July 15 to stock of record June 29; and one per cent on the common stock, payable July 15 to stock of record June 29.

Reports of Earnings.

NEW YORK RAILWAYS.

The New York Railways Company reports for May and five months, ended May, as follows:

	May, 1912	Jan. 1-May 31
Gross	$1,215,048	$5,612,564
Net after taxes	428,319	1,707,917
Other income	32,134	159,430
Total income	460,453	1,867,347
Deduct. incl. int. on underlying bds.	215,636	1,081,262
Interest on refunding 4c	55,894	279,466
Balance	188,923	506,617

BELL TELEPHONE SYSTEM.

The Bell Telephone System in the United States reports for the five months ended May 31, as follows:

	1912.	1911.
Gross	$79,788,638	$72,710,093
Net	23,277,446	21,243,191
Interest	5,473,980	5,727,507
Balance	17,803,466	15,515,684
Dividends	11,955,103	10,479,243
Surplus	5,848,363	5,036,441

AMERICAN TELEPHONE.

The American Telephone & Telegraph Company reports for the six months ended June 30, as follows:

	1912.	1911.
Gross	$20,327,705	$18,203,624
Operating expenses	2,265,502	1,782,461
Net	18,062,202	16,421,163
Charges	2,761,119	2,865,884
Balance	15,301,083	13,555,278
Dividends paid	12,635,710	10,769,555
Surplus	2,665,364	2,785,722

NEW YORK TRACTION.

The aggregate earnings of the principal New York City traction lines as reported to the Public Service Commission for the month of April were as follows:

Total revenue from car mileage for April was $23,738,880; total street operating revenue, $7,538,557; street railway operating income, $3,132,509, and other income, $208,497.

FEDERAL LIGHT AND TRACTION.

The Federal Light & Traction Company, consolidated statement of earnings of subsidiary companies (after elimination of inter-company earnings) for May and twelve months ended May 31, 1912, compares as follows:

	1912.	1911.
May gross	$ 112,183	$ 96,014
May net	43,529	38,452
Twelve months' gross	1,335,631	1,213,026
Twelve months' net	567,240	530,679

The above figures do not include Trinidad Electric, Railway & Gas Company, nor Deming Ice & Electric Company.

SOUTHERN CALIFORNIA EDISON COMPANY.

The Southern California Edison Company reports earnings for May and for five months ended May 31, as follows:

	1912.	1911.
May gross earnings	$ 348,688	$ 288,431
May net earnings	166,216	140,751
Surplus	107,614	85,745
Five months' gross	1,741,441	1,468,538
Five months' net	843,019	735,573
Surplus	542,390	455,765

The surplus for the five months was, after providing for the dividends on the $4,000,000 five per cent preferred stock, at the rate of almost fourteen per cent a year on the $7,900,000 common stock outstanding.

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company reports for the eleven months ended May 31, as follows:

	1912.	1911.
Gross income	$36,986,813	$31,328,928
Expenses	30,424,945	25,002,903
Net revenue	6,561,863	6,326,835
Bond interest	1,558,985	1,588,702
Balance	5,002,883	4,738,133
Dividends	2,742,485	2,742,009
Surplus	2,260,398	1,996,124

The partly estimated earnings of the Western Union Telegraph Company for the quarter ended June 30, 1912, (actual to May 31) compare with the actual figures of former years as follows:

	1912.	1911.
Gross inc.	$11,207,526	.....
Expenses	10,063,319	.....
Net revenue	1,144,207	1,982,493
Bond net	367,628	433,953
Balance	776,579	1,548,540
Dividends	748,005	747,887
Surplus	28,574	800,653

In the comparison of the Western Union Telegraph Company for the quarter ended June 30, 1912, with those of the previous year, the net revenue shows a decrease of approximately $850,000. This apparently large decrease is accounted for in that this year's net revenue allowed for repairs, depreciation, etc.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 15.	July 8.
Allis-Chalmers common (New York)	¼	¼
Allis-Chalmers preferred (New York)	1⅜	1¾
American Tel. & Tel. (New York)	141¾	145¼
Commonwealth Edison (Chicago)	139½	139
Edison Electric Illuminating (Boston)	293	293
Electric Company of America (Philadelphia)	*12¼	12¼
Electric Storage Battery common Philadelphia)	55	55½
Electric Storage Battery preferred (Philadelphia)	55	55½
General Electric (New York)	177¼	180
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2¾	7⅞
Massachusetts Electric common (Boston)	18½	19½
Massachusetts Electric preferred (Boston)	93	*93
National Carbon common (Chicago)	117	115
National Carbon preferred (Chicago)	118	118
New England Telephone (Boston)	161½	163
Philadelphia Electric (Philadelphia)	22	22⅛
Postal Telegraph & Cables common (New York)	89¾	88½
Postal Telegraph & Cables preferred (New York)	69¼	69
Western Union (New York)	81½	82
Westinghouse common (New York)	74⅝	77
Westinghouse preferred (New York)	*118	*118

*Last price quoted.

PERSONAL MENTION.

BION J. ARNOLD, of Chicago, has been engaged by Corporation Counsel Drayton and Mayor Geary as traffic expert to report on a comprehensive street-railway system for the city of Toronto, Canada.

R. L. BARRY, of Minneapolis, Minn., who was a member of the royal commission which recently made an investigation of the Manitoba Government Telephone System, has been appointed sole commissioner in charge of this system.

J. D. BUCKWELL, contract agent of the Toledo Railways & Light Company, has resigned his position to accept a similar one with the Peoria (Ill.) Power & Light Company. W. H. Marshall, former assistant contract agent will fill the vacant position.

C. EDWARD FEE, of the Peerless Lamp Works of General Electric Company, sailed for Europe on July 9. While on the Continent he will spend most of his time with his father, William T. Fee, United States consul at Bremen, Germany. Mr. Fee will return to Warren, O., about August 10.

W. T. GENTRY, president of the Southern Bell Telephone & Telegraph Company, Atlanta, Ga., has been retained by the British Postmaster General at $1,000 per day as expert adviser in the suit of the National Telephone Company. Mr. Gentry was expected to leave London for home on July 16.

RUSSELL H. BALLARD, assistant general manager of the Southern California Edison Company, Los Angeles, is the author of an article entitled "No Honest Corporation Fears Honest Regulation" in the July number of *Edison Current Topics*, published by the company. Mr. Ballard was the chief speaker before the Electrical League of Southern California on June 25, his subject being, "The Seattle Convention of the N. E. L. A."

ARTHUR C. F. KELEHER, assistant sales manager of the Nelite Works of the General Electric Company (formerly of the Holophane Company), has resigned his position and on September 1 will join the sales force of the Foss-Hughes Company, of Philadelphia, agents for the Pierce-Arrow motor car. He will be in the motor-truck department. Mr. Keleher entered the electrical field after three years' service in the paymaster's department of the United States Army. His first position with the Holophane Company was that of salesman. Later he became jobbers' special representative. At the end of four years he had been promoted to the post of assistant to the company's sales manager. He is a Statesman-at-Large of the Sons of Jove.

OBITUARY.

WILLIAM T. REID, chief telephone operator in Bellevue Hospital, New York City, died on July 9 from pneumonia. Mr. Reid was 50 years of age, and had been connected with the hospital for 20 years.

JAMES B. SPEED, of Louisville, Ky., died on July 7 at Rockland Breakwater, Me., of a complicated affection of the heart. Mr. Speed, who was 68 years of age, was one of the organizers of the Ohio Valley Telephone Company, which operated a system in Louisville until purchased by the Bell interests several years ago. He built the first telephone exchange building in the United States. He was also interested in street railways.

CHARLES ODELL, a capitalist largely interested in Massachusetts street railways, died at his home in Salem, Mass., at the age of 73. He was once owner of the Citizens Street Railway Co., of Amesbury, and president of the Naumkeag Street Railways Company; he was also heavily interested in the traction lines of Newburyport. He is survived by a widow and three children.

STEWART S. NEFF, of Philadelphia, vice president of the Philadelphia & Suburban Elevated Railroad Company, who recently offered to build a Philadelphia subway system, died on July 12 at his summer home in Chelsea, near Atlantic City, from heart failure. He was 54 years old. Mr. Neff was born in Cincinnati in 1859. He was graduated from the Troy Polytechnic Institute in 1878, and immediately entered the employ of the Pennsylvania Railroad as assistant engineer, where he remained until 1887, when he was appointed superintendent of the Cornwall Railroad. Three years later he became associated with the Great Northern under James J. Hill, but in 1892 he resigned and became superintendent and chief engineer of the Lake Superior & Ishpeming Railroad. In 1895 Mr. Neff took charge of the Union Elevated Loop, at Chicago. In 1900 he entered the service of the Boston Elevated Railroad as consulting engineer. He was the first to install successfully the electropneumatic system of signals with automatic stops on electric railroads. Upon leaving Boston he was appointed consulting engineer of the Brooklyn Rapid Transit Company, which post he resigned to become general manager of a system of electric lines in Mexico. Mr. Neff returned to the United States in 1906, and superintended the building of the Fast Shore Line, connecting Atlantic City and Ocean City. He was elected president of the Interstate Engineering & Supply Company, of Philadelphia, in 1909. Then he became associated with the Philadelphia Suburban Elevated Railroad Company. Mr. Neff frequently said that he hoped to build the system of subways and elevated lines in Philadelphia as a climax to his career.

NEW PUBLICATIONS.

MAGNETIC OBSERVATIONS.—United States Coast and Geodetic Survey has published the results of observations made at the magnetic observatory near Honolulu, Hawaii, in 1909 and 1910. These have been compiled by Daniel L. Hazard. In addition to the hourly values of the components of the earth's magnetic field, a record is given of earthquakes and magnetic storms.

THE NEBRASKA COMMISSION.—The fourth annual report of the Nebraska State Railway Commission for the year ending November 30, 1911, has come from the press. This contains a disposition of cases coming before the Commission, a compilation of reports made by common carriers, and the result of the physical valuation of the properties of the common carriers which has been made by the Commission.

THE POWER OF OCOEE.—A very attractive brochure with this title has been prepared by J. G. White & Company, of New York City. It is a description of the hydroelectric development of the Ocoee River at Parksville, Tenn., which was designed and built for the Eastern Tennessee Power Company by J. G. White & Company. A map is given which shows the entire development including the transmission lines running west to Chattanooga, northeast to Knoxville and south to Rome. A number of very attractive colored illustrations make clear the progress of the work since it was begun early in 1911 and as it was pushed to rapid completion within about a year of its inception. The dam alone is 840 feet long, and has a spillway 362 feet in length. The ultimate capacity of the Parksville development is about 38,000 horsepower.

REPORT OF MASSACHUSETTS COMMISSIONERS.—The twenty-seventh annual report of the Board of Gas and Electric Light Commissioners of the Commonwealth of Massachusetts has appeared. This covers the calendar year 1911, with reports of companies for the year ending June 30, 1911. The report includes the orders and decisions which have been handed down by the Commission during the year and the cases still pending. Ten appendices are given, including lists of officers of operating companies, statistics, accidents, court decisions, new legislation and special reports to the Legislature. The Commissioners recommend new legislation defining the distinction between electric light companies and power companies, and placing the latter under the regulation of the Commissioners.

DATES AHEAD.

California State Association of Electrical Contractors. Annual convention, San Jose, Cal., July 24-27.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Pennsylvania Electric Association. Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 4-6.

Eighth International Congress of Applied Chemistry. Washington, D. C., September 4; New York, N. Y., September 6-13.

American Electrochemical Society. Fall meeting in conjunction with Electrochemical Section of International Congress, New York, N. Y., September 7, 9 and 10.

Illuminating Engineering Society, Annual convention, Hotel Clifton, Niagara Falls, Ont., September 16-19.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 16-21.

The 1912 Boston Electric Show, Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

The Duplex Metals Company, Chester, Pa., announces that it now has 50,000,000 pounds of copper-clad steel in use which is giving perfect satisfaction.

W. N. Matthews & Brother, St. Louis, Mo., have sent out a booklet calling attention to 42 legal cases that might have been prevented if Matthews fuse switches had been used.

The Electric Sales Company, 286 North Front Street, Columbus, O., has opened a general sales office and warehouse, and will be distributor and manufacturers' agent for electrical specialties.

Walpole Rubber Company, Walpole, Mass., controlling the Massachusetts Chemical Company and other constituent companies, has secured in Foxboro, Mass., the complete plant formerly occupied by the Van Choate Electric Company. This plant embraces over three acres of floor space. The addititional facilities have been made necessary due to the expansion of the Walpole Rubber Company's business.

The Dayton Electrical Manufacturing Company supplied the dynamo, storage battery and other electrical equipment for the yacht *Detroiter* which was fitted out at Detroit, Mich., and started on July 6 to make a trip to St. Petersburg, Russia. This craft is only 35 feet long, and expects to spend 25 days on the trip. Capt. Fleming Day, of New York, is in command with a small crew to assist him.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among numerous orders for railway equipment it has received the following that are particularly noteworthy: the Geary Street Railroad Company, San Francisco, Cal., has ordered 42 quadruple equipments of No. 306 CA motors and HL control; the Philadelphia Rapid Transit Company has ordered 300 double equipments of No. 306 CA motors with K-36G control.

Fort Wayne Engineering & Manufacturing Company, Fort Wayne, Ind., has issued a folder that briefly describes some of its pumping, pressure and displacement systems of water supply and the air compressors and other machinery adapted thereto. Much of this equipment is driven by electric motors, although where electric power is not available gasoline engines are used. The company manufactures a variety of Paul equipment suitable for shallow, medium and deep wells.

The Banner Electric Company, Youngstown, O., expects to occupy its new factory building in Williams Street by the end of this month. The new building has four stories with basement and sub-basement, and has been equipped not only with an idea to good manufacturing facilities, but with an idea to the comfort of the employees. A rest room has been provided and provision made for purifying and cooling the air in the building. The Market Street property will hereafter be used as an office and storage warehouse.

The Department of Publicity of the National Quality Lamp Division of General Electric Company has compiled and is distributing a "Mazda Ad Book," containing suggested models for newspaper advertising copy suitable for use by central stations, electrical dealers and contractors. The advertisements, which set forth the advantages of electric light and of Mazda lamps, are forcefully written and pointedly illustrated. The "Mazda Ad Book" has been strongly approved by the various concerns which have received copies of it, and successful results are being reported from its use.

Westinghouse Church Kerr & Company, New York, N. Y., have been retained as engineer-contractors for the electrical equipment in connection with the extension of the American Cyanamid Company, at Niagara Falls, which is about to double its present capacity; for the new four-story building of the Chesebrough Building Company, of New York City; for the additions to the buildings of the Esmond Mills at Esmond, R. I.; for the new manufacturing building of the Jones Cold Store Door Company at Hagerstown, Md.; and for the design and construction of a power plant for the Andrew McLean Company, at Passaic, N. J.

Kellogg Switchboard & Supply Company, Chicago, Ill., has recently issued a four-page folder describing its "Howler" equipment, which is used so effectively in reminding subscribers who have left receivers off the hook to replace them, thereby preventing loss of time and service. On the cover a wire chief is represented at his desk about to work the howler and below this is shown the 'absent-minded subscriber reading his paper with the receiver off the hook. On the second page is a half-tone illustration followed by a description of the simple apparatus. The booklet is printed in brown ink and is a forceful sales argument.

Green Fuel Economizer Company, Matteawan, N. Y., has just issued catalog No. 142, devoted to Green's economizer. This 104-page catalog is very artistically prepared, the engravings being unusually fine. Latest types of the Green economizer are described and the principle of their application carefully explained. Results obtained in actual installations are given in both graphic and tabular form. A large number of illustrations show typical installations of economizer equipment. Although the Green economizer has found most extensive application in connection with boiler plants, other applications have been made, all of them with highly gratifying results.

Central Electric Company, 320-326 South Fifth Avenue, Chicago, Ill., has issued its general catalog No. 28. This is a massive publication of 1,112 pages, which has very appropriately been termed the "Silver Anniversary Edition" since it commemorates the twenty-fifth year of the company's business. The magnitude of this catalog is such that it is impossible to include a list of even the principal lines of electrical supplies which are described and illustrated. These cover practically every demand for electrical equipment in nearly every line of electrical activity. Supplies and appliances are listed for the smallest to the largest buyers. Considerable space is given at the back of the volume to tables containing valuable data for general reference purposes. A very comprehensive telegraphic code has been adopted to facilitate rapid ordering of material. The book concludes with a double index—first to the list number, and second, a general index by subjects and classes of equipment. The company has also issued a new price list and discount sheet, applying particularly to the new catalog. This in itself has 301 pages. All the material is listed for convenient reference, and the general index gives reference to both the price list and catalog page numbers. Both the catatog and price list mark a decided advance in trade publications of this kind.

Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind., has issued a number of new publications of particular interest. Bulletin No. 1139 is a 56-page publication containing nearly 180 illustrations of motor drives in a large number of industries. These show the adaptability of Fort Wayne motors for driving not only standard machine tools, but for almost every conceivable kind of machinery in a great variety of industries. The attractive form of this publication will doubtless make it in demand. Bulletin No. 1136 is devoted to direct-connected type-MPL direct-current generators. These are described in detail and illustrated both as to their parts and in typical installations. Bulletin No. 1137 describes and illustrates belt-driven revolving-field alternators of form B. These are made in both two-phase and three-phase types and have standard voltages for 60-cycle service. Exciters are also described in the bulletin. Bulletin No. 1140 describes the single-phase repulsion induction motors of the type SR. These are rugged machines that have been found serviceable for a large variety of purposes. The bulletin describes them completely, shows characteristic curves and gives diagrams of connections. Instruction book No. 3053 has just been issued to give the latest advice regarding the operation of multiphase revolving-field generators and belted exciters. A leaflet has also been published that describes and lists the standard types of Ft. Wayne motor-driven ventilating fans.

Record of Electrical Patents.

Issued by the United States Patent Office, July 9, 1912.

1,031,686. Recording Time-Lock. L. C. Bush, assignor to M. S. Park, Columbus, O. Turning of the key actuates an electrical recording mechanism.

1,031,698. Signaling System. C. D. Ehret, Philadelphia, Pa., assignor to Wireless Specialty Apparatus Co. A wave detector charges a condenser which intermittently discharges into the signal receiver.

1,031,707. Automatic Fire-Alarm. M. Gibson, Davisville, Ont., Canada. The circuit is closed at a predetermined temperature.

1,031,708. Electric Current Regulator. J. S. Goodwin, London, Eng. A regulator of the interrupter type for reducing the supply voltage.

1,031,710. Process of Connecting Filaments and Feed Wires for Electric Incandescent Lamps. F. Hanaman, assignor to General Electric Co. The connection to the leading-in wire is made by a special soldering process.

1,031,716. Making Electrically Conducting Joints in Metallic-Filament Incandescent Electric Lamps. A. C. Hyde, London, Eng. The jointing paste contains powdered iron, iron oxide and collodion dissolved in amyl acetate.

1,031,742. Pneumatic Dispatch-Tube Apparatus. C. F. Stoddard, assignor to Lamson Consolidated Store Service Co., Newark, N. J. Includes electromagnetic means for switching the air from the main tube to any of the transmission tubes.

1,031,768.—Pendent Switch.

1,031,743. Alternating-Current Brake-Magnet Apparatus. A. Sundh, assignor to Otis Elevator Co., Jersey City, N. J. The magnet armature reciprocates a piston in an air-tight cup.

1,031,752. Telegraph Transmitter. R. Welty, Sudbrook Park, Md. Relates to the main swing spring bar which carries a dot contact point and a hammer weight.

1,031,768. Switch Mechanism. E. G. K. Anderson, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. A pendent switch actuated by an oscillating button.

1,031,770. Lamp-Manufacturing Machine. G. W. Beadle, assignor to Westinghouse Lamp Co. The materials are fed from reels, cut to length and applied by a plunger.

1,031,787. Rheostat. F. D. Hallock, assignor to Westinghouse Electric & Manufacturing Co. Has a tubular resistance element supported by rods flexibly extended into each end.

1,031,789. Circuit-Interrupter. F. W. Harris, assignor to Westinghouse Electric & Manufacturing Co. Includes a set of levers to secure a quick opening of the circuit.

1,031,795. Lightning Arrester. R. P. Jackson, assignor to Westinghouse Electric & Manufacturing Co. Includes a magnetic blow-out coil adjacent the horn gap.

1,031,796. Lightning Arrester. R. P. Jackson and H. M. Scheibe, assignors to Westinghouse Electric & Manufacturing Co. The air space in a horn gap is thermostatically adjusted.

1,031,801. Vacuum Pump. H. D. Madden, assignor to Westinghouse Lamp Co. Relates to the discharge part of an electric-lamp exhauster.

1,031,802. Hysteresis Starting Device for Induction Motors. B. McCollum, Washington, D. C. The short-circuiting rings of a squirrel-cage rotor are surrounded by rings of a magnetic alloy of manganese that are highly magnetized by the starting current.

1,031,812. Seam-Welding Apparatus. R. F. Nailler, Elyria, O. An electric welding and hammering outfit.

1,031,820. Photographic-Printing Machine. E. Schneider, New York, N. Y. Includes an incandescent lamp in connection with a ruby-glass plate.

1,031,828. Rotary Cutting Tool. F. S. Walters, assignor to Westinghouse Electric & Manufacturing Co. A commutator slotter includes a motor-driven circular saw, adjustable guides and an arm therefor parallel to the saw shaft.

1,031,839. Lighting Device. W. E. Cochran, assignor to Empire Brass Manufacturing Co., Cleveland, O. A portable desk or bracket lamp includes a semi-circular arm along which the base and lamp socket are adjustable.

1,031,847. Thermostat. J. S. Harley, assignor to Universal Automatic Electric Signaling Co., La Crosse, Wis. Includes a tube with end terminals and containing mercury that is connected with a closed circuit so as to open it when the mercury runs out.

1,031,848. Electric Signaling System. J. S. Harley, assignor to Universal Automatic Electric Signaling Co. An automatic fire-signaling system includes thermostats adapted to open a normally closed circuit.

1,031,849. Electric Switching Mechanism. J. S. Harley, assignor to Universal Automatic Electric Signaling Co. The opening of a relay circuit closes the switches to an annunciator circuit.

1,031,853. Oscillating Fan. T. Kargau, assignor to Westinghouse Electric & Manufacturing Co. One of the arms on the rock shaft carries a sector connected to the base, the other arm is connected by a rod to a crank operated by the motor.

1,031,863. Sign Flasher. S. A. Palmer, San Diego, Cal. Includes a circular switchboard with radially arranged switch members operated by a wheel.

1,031,874. Device for Automatically Closing Clocks and the Like. K. Rotzov, Malmö, Sweden. Alongside a cooking vessel is a funnel to receive condensed steam (as soon as any is liberated) and thus actuate an electric closing device.

1,031,882. Driving Gear for Electrically Actuated Trucks or Rail Cars. W. J. Spangler, assignor of one-half to R. Thayer, Philadelphia, Pa., and one-fourth to R. M. Elliott. Has the motor mounted in the middle of the car or truck and double-geared to each axle.

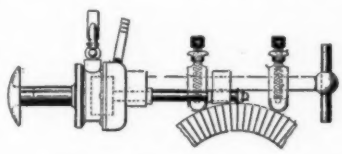
1,031,890. Starter for Vapor Apparatus. P. H. Thomas, assignor to Cooper Hewitt Electric Co., New York, N. Y. Has an insulated pocket for mercury adjacent to cathode.

1,031,893. Centrifugal Switch. J. A. Volk, Jr., South Norwalk, Conn. An insulating, hollow, cylindrical casing has two separate collector rings in its periphery that are connected by mercury when the casing revolves.

1,031,900. Manufacture of Hollow Bodies from Quartz. F. Wolf-Burckhardt, Biebrich, Germany. Silica is fused around an electrical resistance core which is heated to 2,000 degrees centigrade.

1,031,947. Telephone Receiver. C. T. Mason, Sumter, S. C., assignor to Sumter Telephone Manufacturing Co. Has a metal casing with a heavy insulating bushing around the receiver cord.

1,031,963. Tool for Forming Wire Joints. A. B. Probasco, Turtle Creek township. Consists of a hub and a handle, each having curling teeth to twist up the wire ends tightly.



1,031,828.—Commutator Slotter.

1,031,975. Mine Insulator. F. A. Warren, Canon City, Idaho. Consists of a base and a wire holder each having cooperating grooves for a tie.

1,031,976. Attachment of Incandescent Electric Lamps. O. Weber, assignor to Berliner Siriuslampen Vertriebsgesellschaft M. B. H., Berlin, Germany. For securing lamps to a supporting plate or sign; includes a conical sleeve with external bead secured to the plate and an internal flexible bead to grasp the lamp base.

1,032,027. Connection for Running Arc Iamps. W. Schäffer, Berlin, Germany. Regulation is secured by a group of incandescent lamps and electrolytic cells.

1,032,029. Rotary Mixer. H. A. Seifke, San Francisco, Cal. Is driven by means of an electric motor through a flexible shaft.

1,032,030. Circuit-Closer. G. H. Sloane, Boston, Mass., assignor of one-half to H. B. Waters, and H. Plimpton. A swing arm normally held in its middle position is adapted to close either of two circuits.

1,032,033. Automatic Safety Device. G. E. Thurber, Michigan City, Ind., assignor of one-half to E. J. Bower. Includes motor-generators on an electric car to control the safety devices.

1,032,048. Portable Flash-Light Apparatus. N. Dowling, Philadelphia, Pa. Includes a battery and circuit-closer for igniting the powder.

1,032,058. Junction Box. H. R. Gilson, assignor to National Metal Molding Co., Pittsburgh, Pa. The side walls of the box have cuts of small size which, when bent down, form connecting lugs integral with the bottom.

1,032,068. Driving Mechanism for Electrically Propelled Vehicles. J. Krohn, Chicago, Ill. The motor is mounted concentric with the axle and drives it through a sleeved transmission gear.

1,032,099. Sparking Plug for Internal-Combustion Engines. A. Zähringer, assignor to firm of Robert Bosch, Stuttgart, Germany. Relates to the construction details.

1,032,102. Danger Signal for Electric Cars. J. Anderson, Jr., Omaha, Neb. Mounted in separate compartments of a casing are an electric bell and an electric lamp.

1,032,108. Self-Winding Clock. S. S. Besore, Urbana, Ill. Includes an electromagnet to rewind the main spring.

1,032,119. Electric Table Lamp. W. A. B. Dalzell and A. C. Scroggins, assignors to Fostoria Glass Co., Moundsville, W. Va. Provides a special mounting of the socket in the neck of the lamp.

1,032,133. Connecting Plug. C. L. Hagen, New York, N. Y. Adapted for use with a special wall or floor receptacle.

1,032,141. Pneumatic Dispatch-Tube Apparatus. C. S. Jennings, assignor to Lamson Consolidated Store Service Co., Newark, N. J. Includes a motor-driven pump that can be started and stopped from both ends of the line.

1,032,150. Pneumatic Dispatch-Tube Apparatus. J. G. Maclaren, assignor to Lamson Consolidated Store Service Co. Provides electrical control for the motor-driven exhaust pump and for some of the valves.

1,032,153. Insulator. M. Nemes, Fort Dodge, Ia. Has an L-shaped wire clamp passing through and recessed in the insulator.

1,032,155. Pneumatic Dispatch-Tube Apparatus. A. W. Pearsall, assignor to Lamson Consolidated Store Service Co. Includes electric valve control.

1,032,158. Electrode for Secondary Galvanic Cells. H. P. R. L. Pörscke and J. A. E. Achenbach, Hamburg, Germany. The active material for an alkaline storage battery is thinly pasted on a fine meshed corrugated fabric and then compressed to form a porous cake.

1,032,188. Fuse Block. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. A meter-testing connection block with a set of adjacent cartridge-fuse terminals and means for cross-connecting them.

1,032,203. Electric Gas-Lighter. H. D. Grinnell, Pittsfield, Mass. Spring conducting wires hold caps with spark points to the burner tip.

1,032,206. Electric Lamp-Socket Attachment. W. Haas, New York, N. Y., assignor of one-half to E. I. Hanson. Secured at right angles to a shade-carrying socket is an arm with a rock shaft to transmit the motion of pendent cord to a pull switch.

1,032,231. Trolley Head. R. J. Meyers, Florence, Ariz., assignor of one-half to J. R. Pearce. Has spirally grooved trolley-replacing rollers on either side of the wheel.

1,032,246. Method of Treating Carbon. W. A. Smith, assignor to International Acheson Graphite Co., Niagara Falls, N. Y. Consists in passing current through the material while it is advanced at right angles to the current flow.

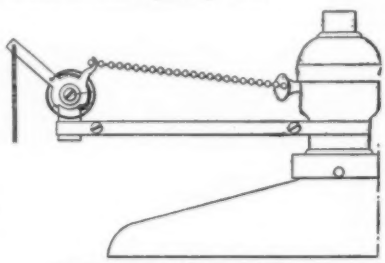
1,032,247. Electrode. W. A. Smith, assignor to International Acheson Graphite Co. Consists of graphite layers with parallel carbon interspaces.

1,032,248. Composite Electrode. W. A. Smith, assignor to International Acheson Graphite Co. Has laterally exposed graphite surface layers with an interlocked carbon filling.

1,032,249. Gutter Box. E. W. Snow, Rochester, N. Y. Has sets of special wall bushings for the main and lateral cables and a special casing with removable cover for each cable.

1,032,250. Composite Electrode. E. C. Speiden, assignor to International Acheson Graphite Co. Consists of rectangular carbon bars built up side by side to form a column with noncoincident transverse joints.

1,032,262 and 1,032,263. Electric Arc Lamp. T. E. Adams, assignor to Adams-Bagnall Electric Co., Cleveland, O. The upper electrode is drawn up in starting the arc and the lower electrode is subsequently fed.



1,032,206.—Pull-Cord Attachment.

1,032,267. Means for Transforming Electric Energy into Heat. C. A. Bastian, London, Eng. Consists of a spirally wound resistance element inside a quartz covering.

1,032,295. Means for Protecting Pipes from the Injurious Action of Electric Currents. G. Politz, Kattowitz, Germany. A bond connects adjacent pipe sections around the jointing gasket.

1,032,301. Electric Meter. G. A. Scheeffer, assignor to Columbia Meter Co., Indianapolis, Ind. Relates to the armature construction of a motor-type watt-hour meter.

1,032,306. Pot-Charger for Linotype Machines. E. E. Spencer, New York, N. Y. An electric circuit closed by the rise of metal in the pot throws a flow-interrupter into action.

1,032,320. Elevator Safety Mechanism. C. G. Armstrong, Orange, N. J. A special motor drives a wormwheel shaft with spur gears on a vertical rack during the normal operation of the car only.

1,032,345. Railway Block System. W. G. Roome, assignor to Union Switch & Signal Co., Swissvale, Pa. Includes a sectionalized third rail or trolley for the signaling circuits.

1,032,360. Telephone-Receiver Holder. F. H. Goss, Coraopolis, Pa. A framework for holding a receiver to each ear.

1,032,362. Electric Lock Lamp Socket. A. J. Kempien, St. Paul, Minn. Includes a swiveling threaded shell that is locked when the lamp is being screwed in or out.

1,032,363. Automatic Stop for Elevators. P. L. Manlet, St. Paul, Minn., assignor of one-fourth to W. J. Kout, St. Paul, Minn. A circuit-breaker is opened when the car runs past its limit.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 16, 1912:

542,617. Running Gear for Electric Railways. B. J. Arnold, Chicago, Ill.

542,618. Telephone Relay or Repeater. C. H. Arnold, Boston, Mass.

542,619. Telephonic Repeating Circuit and Apparatus. C. H. Arnold, Boston, Mass.

542,625. Carbon for Electric Lamps. H. F. Cabirau, Paris, France.

542,640. Electric Governor. W. H. Handy, Lake Roland, Md.

542,657. Telephone Relay Apparatus. W. L. Richards, Malden, Mass.

542,658. Telephone Repeating Circuit and Appliances. W. L. Richards, Malden, Mass.

542,662. Electric Arc Lamp. E. Thomson, Swampscott, Mass.

542,663. Electric Measuring Instrument. E. Thomson, Swampscott, Mass.

542,664. Electric Annunciator. H. C. Thomson, Boston, Mass.

542,667. Regulation of Continuous-Current Motors. M. J. Wightman, Scranton, Pa.

542,670. Cable Railway. W. M. Wood and J. C. Miller, Elmira, N. Y.

542,679. Coin-Controlled Telephone. C. B. Hopkins and T. H. Elsom, Spokane, Wash.

542,697. Burglar-Alarm Circuit-Closer. A. A. Vanderpool, Newark, N. J.

542,699. Railway Signal. F. B. Wetherbee, Walpole, Mass.

542,761. Electric Block Signal for Railroads. A. C. Gordon, Rochester, N. Y.

542,769. Electric Signal Apparatus. T. B. Keller, Rahway, N. J.

542,771. Means for Generating Electricity from Car-Wheel Axles. M. Moskowitz, Newark, N. J.

542,772. Make-and-Break Switch. M. Moskowitz, Newark, N. J.

542,773. Polarized Compound Switch. M. Moskowitz, Newark, N. J.

542,775. Fire Alarm. J. R. McCoy, Marshalltown, Ia.

542,848. Electric Switch. G. T. Wyanson, Philadelphia, Pa.

542,913. Telephonic Relay or Repeating System. C. H. Arnold, Boston, Mass.

542,916. Electrical System for Signaling Between Trains. Basanta y Baque, Madrid, Spain.

542,926. Electric Annunciator. W. J. Clarke, Trenton, Canada.

542,945. Electric Meter. H. A. Rowland, Baltimore, Md.

542,953. Elements of Galvanic Batteries. F. A. von Alimonda and N. von Alimonda, Sagrado, Austria-Hungary.

542,959. Electric Gas-Lighter. H. G. Grier, Philadelphia, Pa.

542,968. Regulator for Alternating Electric Circuits. C. P. Steinmetz and A. H. Armstrong, Schenectady, N. Y.

542,979. System of Electrical Distribution. G. W. von Siemens, Berlin, Germany.